



ARCHIVES OF

*Physical Medicine  
and  
Rehabilitation*

AUGUST 1960

Volume 32, No. 8

3rd International Congress of Physical Medicine  
IIIe Congres international de Medecine Physique  
3° Congreso internacional de Medicina Fisica  
3. internationaler Kongress für Physikalische Medizin

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# ARCHIVES OF *Physical Medicine and Rehabilitation*

OFFICIAL JOURNAL

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION



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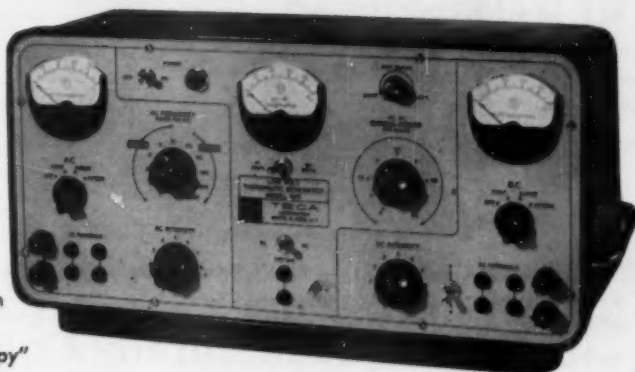
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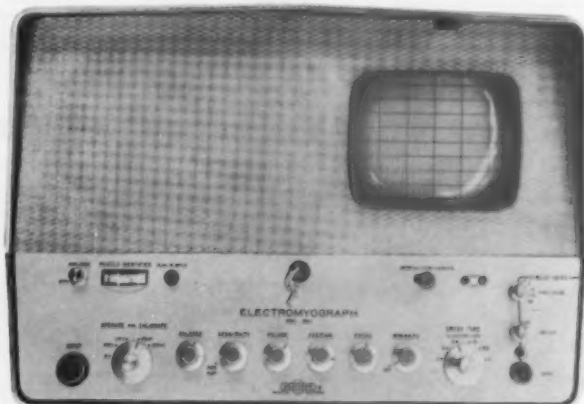
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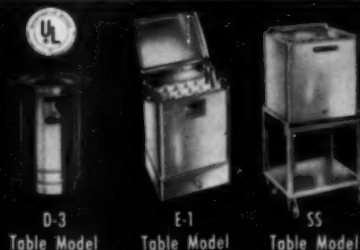
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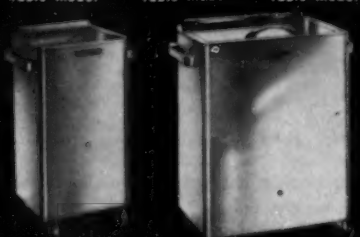
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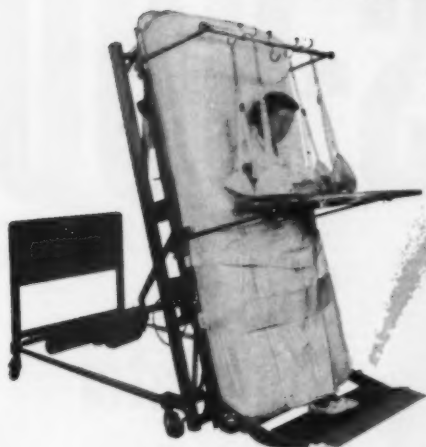
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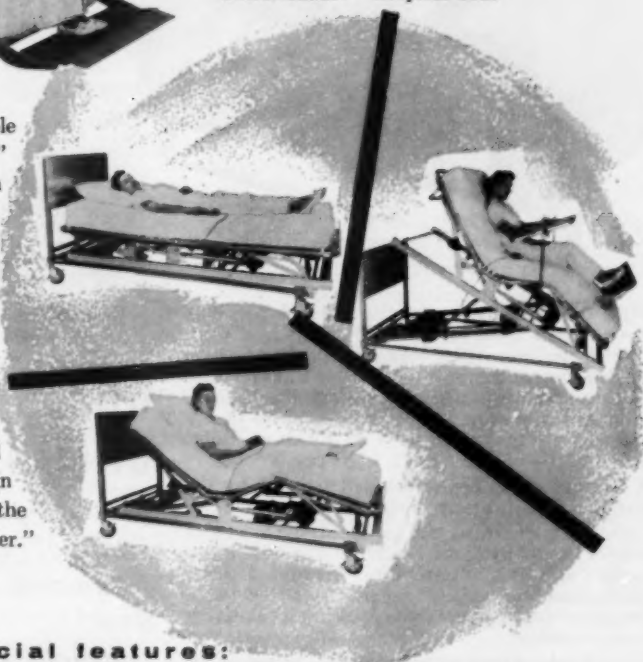
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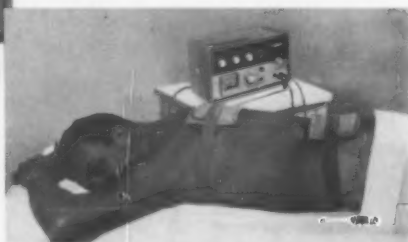
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# An Approach to Disability Evaluation

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and

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New York City

● Because measuring yardsticks in medicine frequently are based on inadequate clinical data there is a need for accurate methods of measurement. This is true especially in physical medicine and rehabilitation since it is one of the younger specialties. The need particularly is felt in functional evaluation and prognosis; the inadequacies in these areas being pinpointed by a study of 400 patients with functional deficiencies living in nursing homes. Some significant findings include: many patients, thought previously to have functional deficiencies in activities of daily living, were able to perform independently when given an objective activities of daily living test in a place other than the patient's usual residence; lack of agreement existed between competent physicians in their estimations of the patients' suitability for rehabilitation; disagreement was found as to which were the key factors in formulating decisions of patient acceptability; early results in many patients did not bear out the recorded prognostications of physicians. Important factors, listed by a number of physiatrists, in evaluating the disabled patient were grouped into four major categories on forms and then organized for the major conditions seen in the geriatric nursing home population. The projected technique of measurement was tested by several physiatrists on 60 patients of a hospital's rehabilitation service, problem areas were noted and the forms modified accordingly. Patients in the nursing home study are being tested with these forms. When this larger study is completed it will be analyzed to ascertain the data's validity and in an attempt to develop an improved prognostic method. The use of the forms, therefore, is a proposed first step in the direction of objectifying evaluation in rehabilitation.

There is a need for accurate methods of measurement in all of medicine. Measuring yardsticks now frequently are based on inadequate clinical data; therefore, to some extent medical decision appears to be of an intuitive nature. For example, in evaluating the feasibility of patients for rehabilitation we often are incapable of giving the exact reasons for the conclusion reached. In some instances, when interrogated, the physiatrist is unable to clearly state the nature of the factors that entered into the final decision. The clinical muscle test can be cited as another example of measurements that are not replicable; in fact, some examiners hesitate to compare the results of testing performed by different individuals on the same patient.

Physical medicine and rehabilitation, being one of the younger specialties, perhaps has a greater need for the development of methods of mensuration than have some of the older medical fields. This need is particularly apparent in functional evaluation and prognosis. The present inadequacies in these areas were borne out by the problems encountered

in an investigation being conducted by the department of physical medicine and rehabilitation of the New York Medical College entitled "The Study of Rehabilitation Potential of Nursing Home Population," which has the following objectives:

1. To determine how many patients with functional impairment, residing in nursing homes, are suitable for rehabilitation.
2. To determine whether a rehabilitation program for these patients will result either in a significant improvement of function or in slow deterioration of function.
3. If such an improvement is found, to determine whether it is best achieved by a rehabilitation program in a nursing home or in an inpatient rehabilitation facility.
4. To determine the cost of such rehabilitation services in a nursing home and an inpatient rehabilitation facility.

## Description of Study

The study consists of 400 patients with functional deficiencies residing in proprietary nursing homes in New York City. One hundred of these patients are being treated by a full complement of rehabilitation personnel sent into the

Read at the Thirty-seventh Annual Session of the American Congress of Physical Medicine and Rehabilitation, Minneapolis, September 3, 1959.

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This study was supported by grants from The National Institutes of Health and The Benjamin Rosenthal Foundation. Cooperation received from Milton Holtzman, M.D.; Oswaldo Migiletta, M.D., and Bruce Grynbaum, M.D., as well as assistance given by Albert Einstein Medical Center; New York City Department of Health; New York City Department of Hospitals; New York City Department of Welfare; New York City Mental Health Board; New York State Department of Health, and the New York State Rehabilitation Hospital at West Haverstraw is gratefully acknowledged by the authors.



nursing homes. A second 100 were transferred to inpatient rehabilitation facilities for treatment. The remaining 200 patients serve as controls. When the treated patients in the first two groups reach maximal improvement, they receive maintenance care. Each patient is treated over a two-year period. In choosing the case load, emphasis was placed on inclusion of as many patients as possible. All patients with functional disabilities were accepted except those who were deemed too ill to participate. This is at variance with common practice, in that many patients with extreme disability were included who would not be considered eligible for rehabilitation care under ordinary circumstances.

The stability of the population and long duration of the study permit excellent opportunity for research. In these circumstances, evaluation of improved therapeutic methods and experimental analytic technics are easily carried out, since the same patients will be available for observation over a long period of time.

### Early Findings

This study has been in operation for approximately one year, and the total patient population has been obtained. Therapy, both in the nursing homes and in inpatient rehabilitation facilities, is well under way. Early results have highlighted many important questions, in the area of both psychiatric evaluation and prognostic accuracy. Following are some of the significant findings:

1. Of those patients accepted for the study as having functional deficiencies in activities of daily living on the basis of competent psychiatric screening, many were found to be able to perform independently when given an objective activities of daily living test elsewhere than the patient's usual residence. This has placed doubt upon the ability of the qualified physician to evaluate clinically such functional impairment at the patient's usual residence.

2. Considerable disparity of opinion has been found to exist between competent physicians in their estimations of

suitability for rehabilitation. In fact, in the questioned cases where more than one qualified opinion was obtained, lack of agreement was noted in a significant number of instances.

3. Even where psychiatrists agreed on the acceptance of patients, there was considerable difference of opinion as to which factors were of key importance in formulating their decision.

4. A clinical prognosis as to feasibility for rehabilitation, probable duration of necessary treatment and anticipated degree of improvement was made for each accepted patient. Early results in a significant number of these patients have not borne out the recorded prognostications. This difficulty is highlighted in clinical experience by the frequency with which rehabilitation candidates are often admitted to centers for a "trial" of therapy.

Such discrepancies in areas fundamental to the rehabilitation process emphasize the need for development of suitable criteria for improved evaluation and prognosis. They have led, consequently, to the present report.

### A Method of Disability Evaluation

The technic to be presented has been developed in an attempt to answer some of the questions regarding patient evaluation. Many studies have been done in the past to improve patient identification. Moskowitz has described and implemented an adaptation of the army's PULSES method. Sokolow has designed an elaborate method which employs an International Business Machine system. The forms presented here are simple, do not require special equipment, and are inexpensive. Their design permits accurate reduplication and is suitable as a research tool for the development of greater competence in patient identification and eventually as a basis for improved psychiatrist competence in prognosis.

### Method

A number of psychiatrists were asked to list factors which they considered of importance in evaluating the disabled pa-



NEW YORK MEDICAL COLLEGE  
*Study of Rehabilitation Potential of Nursing Home Population*  
 PHYSIATRIST'S DISABILITY EVALUATION  
 BASED ON DIAGNOSIS  
 HEMIPLEGIA

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(Patient's Name)

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(Nursing Home)

**Note:**

In evaluating the various factors below the examiner is to proceed with the hypothetical assumption that the factor he is evaluating is the only pathological factor present. *Example:* When motor power is tested, assume that this factor is being evaluated in a limb where factors 2, 3, 4 and 5 test as normal. Similarly, if spasticity is being evaluated assume that factors 1, 3, 4 and 5 are normal. No attempt is to be made to evaluate the relative quantitative contribution of the factor tested in the total picture where other pathology such as spasticity, contracture, etc., is present.

**A. MUSCULOSKELETAL MOBILITY****1. Motor Power****a. Uppers**

- |       |   |   |
|-------|---|---|
| _____ | + | normal or slight interference with function           |
| _____ | 0 | weakness—mild or moderately interfering with function |
| _____ | — | weakness—severely interfering with gross functions    |

**b. Lowers**

- |       |   |   |
|-------|---|---|
| _____ | + | normal or slight interference with function           |
| _____ | 0 | weakness—mild or moderately interfering with function |
| _____ | — | weakness—severely interfering with gross functions    |

**2. Spasticity (spasm, spasticity, rigidity, tremor)****a. Uppers**

- |       |   |   |
|-------|---|---|
| _____ | + | normal or slight interference with function           |
| _____ | 0 | weakness—mild or moderately interfering with function |
| _____ | — | weakness—severely interfering with gross functions    |

**b. Lowers**

- |       |   |   |
|-------|---|---|
| _____ | + | normal or slight interference with function           |
| _____ | 0 | weakness—mild or moderately interfering with function |
| _____ | — | weakness—severely interfering with gross functions    |

Fig. 1

tient. These factors were then grouped arbitrarily into four major categories (figs. 1-4):

1. *Musculoskeletal Mobility*—such as the testing of motor power and evaluation of spasticity, contracture, and co-ordination.

2. *Appreciation of Stimuli*—such as the testing of sensation and vision and the evaluation of pain.

3. *Orientation and Contact*—such as the ability to communicate and to understand written or verbal commands.

4. *Miscellaneous*—such as weight, cardiac status, age and progression of disability.

Separated into these categories the forms were organized for the major conditions seen in the geriatric nursing home population. These included: (1) hemiplegia, (2) amputation, (3) arthritis, (4) hip fracture and (5) Parkinsonism.

A sixth form was prepared for the remaining patients, with the anticipation that additional forms for other condition might be evolved as experience accumulated.

**Analysis of Method Employed**

In designing the forms it was recognized that many factors pass through the physician's mind as he formulates his clinical impression. In order to clarify what factors might enter into such clinical judgment, as noted earlier, several physiatrists were requested to list those considered to be of importance. It was felt that only after careful analysis of the various factors could their relative importance in the final conclusion be determined. For example, since such clinical impressions usually include an evaluation of the patient's needs, as well as evaluation of the quality of required

## HEMIPLEGIA

3. Contracture (Careful delineation is to be made to differentiate contracture from spasticity, protective spasm or painful limitation of range of motion.)
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 weakness—mild or moderately interfering with function  
 \_\_\_\_\_ - weakness—severely interfering with gross function
4. Dominant Side
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 weakness—mild or moderately interfering with function  
 \_\_\_\_\_ - weakness—severely interfering with gross function
5. Coordination on Uninvolved Side (Give neurological interpretation only. Lack of coordination due to other factors, such as motor or sensory loss, is not to be considered.)
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 weakness—mild or moderately interfering with function  
 \_\_\_\_\_ - weakness—severely interfering with gross function

## B. APPRECIATION OF STIMULI

1. Sensory Loss (Bilateral, simultaneous stimulation is to be used. If present, grade as "0," if no other sensory pathology is present.)
- a. Uppers
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 mild or moderate interference with function  
 \_\_\_\_\_ - severe interference with function
- b. Lowers
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 mild or moderate interference with function  
 \_\_\_\_\_ - severe interference with function
2. Vision (Hemianopsia to be tested. If present, grade as "0," if no other visual pathology is present.)
- \_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 mild or moderate interference with function  
 \_\_\_\_\_ - severe interference with function
3. Pain
- \_\_\_\_\_ + absent  
 \_\_\_\_\_ 0 present but not interfering with activities  
 \_\_\_\_\_ - interfering with normal activities, including participation in rehabilitation

Fig. 2

care, all these areas were felt to be in need of study.

Each of the earlier-mentioned diagnoses or syndromes was evaluated on a separate form since it was felt that such primary conditions encompassed and colored for the physician all other factors considered. For example, without knowledge of these primary diagnoses or syndromes proper understanding of a patient's status was felt to be impossible (figs. 5-6).

An attempt was made to reduce the scoring of each item to the simplest possible technic. This was because in clinical practice elaborate forms and procedures are not feasible. Three quantitative groupings were used:

+ = Normal or not interfering with gross function.

0 = Impairment, moderately or minimally interfering with gross function

- = Severe interference with gross function.

These groupings were felt to be gross enough to permit the examiner to categorize the patient properly but not so gross as to be too all-encompassing and with too great a leap from one level of function to the next.

## Procedure

The projected technic was tested by several physiatrists on 60 patients being treated on the rehabilitation service of Bird S. Coler Hospital, a New York Medical College chronic disease facility. Problem areas were noted and the forms changed accordingly to minimize ob-

## HEMIPLEGIA

## C. ORIENTATION AND CONTACT

1. Orientation
  - \_\_\_\_\_ + normal
  - \_\_\_\_\_ 0 slight, none or minimal interference with rehabilitation
  - \_\_\_\_\_ - significant, interfering with participation in rehabilitation
2. Communication
  - \_\_\_\_\_ + normal
  - \_\_\_\_\_ 0 reduced but adequate
  - \_\_\_\_\_ - no useful communication
3. Understanding of Commands, Speech, or Writing
  - \_\_\_\_\_ + normal
  - \_\_\_\_\_ 0 reduced but adequate
  - \_\_\_\_\_ - no understanding

## D. GENERAL FACTORS

1. Duration of Disability
  - \_\_\_\_\_ + under 1 year
  - \_\_\_\_\_ 0 1 — 2 years
  - \_\_\_\_\_ - over 2 years
2. General Nutrition and Appearance
  - \_\_\_\_\_ + excellent metabolic state (appears younger than chronologic age)
  - \_\_\_\_\_ 0 average good nutrition
  - \_\_\_\_\_ - poor appearance (appears older than chronologic age)
3. Reaction to Disability
  - \_\_\_\_\_ + actively interested in overcoming disability
  - \_\_\_\_\_ 0 passive acceptance, no aspirations
  - \_\_\_\_\_ - depressed, withdrawn or other negative reaction
4. Community Contacts
  - \_\_\_\_\_ + a number of close contacts — community and family
  - \_\_\_\_\_ 0 limited community contacts in the form of friends and family
  - \_\_\_\_\_ - no community or family contacts
5. Age
  - \_\_\_\_\_ + below 40
  - \_\_\_\_\_ 0 intermediate
  - \_\_\_\_\_ - 65 or more

Fig. 3

server differences. The eventual objective is to obtain a high degree of replication in the findings.

## Some Problems Encountered in Testing

In evaluating the relative contribution of a pathologic finding as a cause of functional impairment in an anatomic part where other pathologic factors were present, careful orientation of the physician was found necessary. For example, when testing motor power in a limb where spasticity, ataxia and contracture were found, clinicians differed considerably in the quantitative (+, 0, -) value to be apportioned this factor alone (fig. 1).

To minimize such differences the examiner was instructed to proceed with the assumption that each factor evaluated was the only pathologic finding

present. No attempt was to be made to consider its relative contribution to functional impairment. As an example, when testing motor power it was to be assumed that this was being evaluated in a limb where spasticity, ataxia, contractures and so on were absent. It was felt that in this way the physician would best be able to determine the degree to which such motor loss was responsible for the noted functional loss. Having isolated the respective factors and having attained a value for each one, it is inappropriate to combine these factors in arriving at a level of function. Such recombination of a number of different factors leads to many inaccuracies. For example, if an examiner attempts to give a group value to "appreciation of stimuli," one of our form categories, in a patient in whom sensation was minimally involved, vision maximally impaired and

## HEMIPLEGIA

6. Weight (To be actually taken or obtained from recent records.  
Do not use visual estimate.)  
 \_\_\_\_\_ + normal or 10-20% below  
 \_\_\_\_\_ 0 10% above normal  
 \_\_\_\_\_ - 20% or more above or below
7. Secondary Diseases  
 \_\_\_\_\_ + none or one or more not significantly influencing rehabilitation or slightly influencing rehabilitation  
 \_\_\_\_\_ 0 one or more moderately influencing rehabilitation  
 \_\_\_\_\_ - secondary disorders which negatively influence rehabilitation to significant degree
8. Sphincter Control  
 \_\_\_\_\_ + continent  
 \_\_\_\_\_ 0 infrequently incontinent  
 \_\_\_\_\_ - grossly incontinent
9. Cardiac Status  
 \_\_\_\_\_ + Class I  
 \_\_\_\_\_ 0 Class II  
 \_\_\_\_\_ - Class III
10. Progression (Functional progression re: ability to perform activities of daily living.)  
 \_\_\_\_\_ + regression  
 \_\_\_\_\_ 0 static  
 \_\_\_\_\_ - progression
11. Rate of Change of Disability (In a progressive disorder—in a physiopathologic sense. Leave out if not pertinent.)  
 \_\_\_\_\_ + slow rate of progression with periods of remission  
 \_\_\_\_\_ 0 slow rate of progression  
 \_\_\_\_\_ - rapid rate of progression with no periods of remission

---

 (Examining Physician)

---

 (Date of Examination)

Fig. 4

moderate pain present, it would be difficult to decide whether the group value should be +, 0, or -. If isolation of factors is not maintained different examiners designate different values.

It was found necessary to record the value of many of the considered factors separately for each local anatomic part to delineate its significance as a disabling agent. For example, in hemiplegia, motor loss in the dominant upper extremity is of different significance from motor loss on the nondominant side in terms of function. Whether it is present in the upper or in the lower extremity is again of importance. The statement as to the value of a factor for the body as a whole, therefore, was found to be too gross for proper understanding.

Medical terminology had to be carefully defined in order to avoid difficulty. The meaning of a particular factor differed among examiners. For example, "progression of findings" may be inter-

preted in two different ways. It may be given a physiopathologic meaning referring to worsening of the underlying disease process. Again, it might refer only to increasing involvement in the ability to perform the activities of daily living in a patient in whom the underlying disease process remains unchanged. In amyotrophic lateral sclerosis, for example, the disease itself might progress. In hemiplegia, the patient might be able to do less and less for himself because of disuse or lack of motivation. It was therefore found necessary to specify exactly what is meant when this factor is evaluated (fig. 4).

Detailed instruction as to exactly what tests were to be included in examining a particular system was found necessary. When this was not done the observer frequently left out required examination procedures.

For example, when testing vision, unless a confrontation test for hemianopsia

NEW YORK MEDICAL COLLEGE  
*Study of Rehabilitation Potential of Nursing Home Population*  
 PHYSIATRIST'S DISABILITY EVALUATION  
 BASED ON DIAGNOSIS  
 AMPUTATIONS

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(Patient's Name)

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(Nursing Home)

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**Note:**

In evaluating the various factors below, the examiner is to proceed with the hypothetical assumption that the factor he is evaluating is the only pathological factor present. *Example:* When motor power is tested, assume that this factor is being evaluated in a limb where factors 2, 3, 4 and 5 test as normal. Similarly, if spasticity is being evaluated assume that factors 1, 3, 4 and 5 are normal. No attempt is to be made to evaluate the relative quantitative contribution of the factor tested in the total picture where other pathology such as spasticity, contracture, etc., is present.

**A. MUSCULOSKELETAL MOBILITY****1. Level of Amputation****a. Lowers**

\_\_\_\_\_ + foot or less  
 \_\_\_\_\_ 0 below knee  
 \_\_\_\_\_ - above knee

**b. Uppers**

\_\_\_\_\_ + hand or less  
 \_\_\_\_\_ 0 below elbow  
 \_\_\_\_\_ - above elbow

**2. Extent of Involvement**

\_\_\_\_\_ + one extremity  
 \_\_\_\_\_ 0 two (2) extremities  
 \_\_\_\_\_ - more than two (2)

**3. Motor Power — Uninvolved Lower Extremity if Single Amputation**

\_\_\_\_\_ + normal or slight interference with function  
 \_\_\_\_\_ 0 mild or moderate interference with function  
 \_\_\_\_\_ - severe interference with function

**4. Motor Power — Involved Extremity or Extremities**

\_\_\_\_\_ + none or slight interference with residual function  
 \_\_\_\_\_ 0 mild or moderate interference with residual function  
 \_\_\_\_\_ - severe interference with residual function

**Fig. 5**

was specified, certain examiners evaluated only visual acuity (fig. 2). Unless bilateral simultaneous stimulation was specifically required, it was frequently not included in the tests for sensory loss. Hemianopsia and hemisensory loss were found to require predetermined values (+, 0, -) since the quantitative significance of these findings was found to be different for different observers. Therefore, in order to avoid discrepancies in the tabulation of data, these factors were given fixed values.

The 200 patients now being treated in the nursing home study are being tested with these forms. When this larger study is completed and final functional status will have been evaluated, an analysis will be made of the data contained in the

forms, both from the viewpoint of their validity and in an attempt to develop an improved prognostic method.

**Discussion**

Evaluation of both function and change in function is fundamental to the rehabilitation process. As in any developing aspect of medicine such evaluation is now mainly dependent on empiric knowledge as expressed through clinical judgment. Clinical judgment often is adequate in evaluation of the management of an individual patient, however, more objective methods need to be employed for evaluation of groups of patients. Also, clinical judgment does not lend itself readily to communication so that its

NEW YORK MEDICAL COLLEGE  
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 PHYSIATRIST'S DISABILITY EVALUATION  
 BASED ON DIAGNOSIS  
 HIP FRACTURES

\_\_\_\_\_  
 (Patient's Name)

\_\_\_\_\_  
 (Nursing Home)

**Note:**

In evaluating the various factors below, the examiner is to proceed with the hypothetical assumption that the factor he is evaluating is the only pathological factor present. *Example:* When motor power is tested, assume that this factor is being evaluated in a limb where factors 2, 3, 4 and 5 test as normal. Similarly, if spasticity is being evaluated assume that factors 1, 3, 4 and 5 are normal. No attempt is to be made to evaluate the relative quantitative contribution of the factor tested in the total picture where other pathology such as spasticity, contracture, etc., is present.

**A. MUSCULOSKELETAL MOBILITY****1. Motor Power****a. Uninvolved Lower**

- \_\_\_\_\_ + normal or slight interference with function
- \_\_\_\_\_ 0 weakness — mild or moderately interfering with function
- \_\_\_\_\_ - weakness — severely interfering with gross functions

**b. Involved Lower**

- \_\_\_\_\_ + normal or slight interference with function
- \_\_\_\_\_ 0 weakness — mild or moderately interfering with gross functions
- \_\_\_\_\_ - weakness — severely interfering with gross functions

**2. Contracture** (Careful delineation is to be made to differentiate contracture from protective spasm or painful limitation of range of motion, or spasticity.)**a. Uninvolved Lower**

- \_\_\_\_\_ + normal or slight interference with function
- \_\_\_\_\_ 0 weakness — mild or moderately interfering with function
- \_\_\_\_\_ - weakness — severely interfering with gross functions

**b. Involved Lower**

- \_\_\_\_\_ + normal or slight interference with function
- \_\_\_\_\_ 0 weakness — mild or moderately interfering with function
- \_\_\_\_\_ - weakness — severely interfering with gross functions

**c. Uppers**

- \_\_\_\_\_ + normal or slight interference with function
- \_\_\_\_\_ 0 weakness — mild or moderately interfering with function
- \_\_\_\_\_ - weakness — severely interfering with gross function

Fig. 6

transmission in the teaching of residents in physical medicine and rehabilitation is extremely restricted or lost.

We have presented a proposed first step in the direction of objectifying evaluation in rehabilitation. The approach taken reflects an abstraction and organization of factors that are commonly employed in clinical judgment. These factors have been tested for reliability, reduplication and validity. Early experience indicates that, though the problems in evolving this technic are formidable, further exploration and refinement are warranted.

It is hoped that, as experience accumulates, subsequent tests will be de-

veloped that will measure objectively many of the factors now entering into clinical judgment. For example, tests for such motor activities as power, skill, coordination and endurance may be developed to the point where relative numerical values can be assigned. Similarly, psychological factors such as orientation, memory and learning ability also may be rated. Eventually even social factors such as family, employment history and social contacts also may be assigned numerical values. The composite values would provide a profile acceptable to all trained observers and permit useful application in research and teaching.



The nursing home study has revealed a number of other interesting observations relative to the nursing home population. These data seem to signalize how little we know of the characteristics of a significant part of our chronically ill, old population. We have found that 60 per cent of a total of 1,375 patients screened do not suffer from functional impairment, by our standards of activities of daily living. This is significant, since they are apparently residing in nursing homes because of such impairment. Does this signify that they have been improperly placed and that their present disposition does not reflect the actual community need? This is not necessarily true. Such patients may be able to function in a sheltered environment but may be incapable of sustained independent function when placed in the community. Certainly further study is necessary to clarify their status. It is apparent, therefore, that more factors than we employ at the present time must be identified and itemized. Evaluation apparently must take into account the environmental influence upon function.

Another interesting finding is the difference in opinion as to the level of function of those patients accepted for inclusion in the study. Public assistance re-

cipients are granted living allowances based on the degree of dependency. The level of their function, the basis of such payment, is determined by physicians before and periodically during their stay in the nursing home. The following is a functional breakdown of some of our patient load chosen at random. This dis-

Level of Function	Maximum Loss of Function	Intermediate Loss of Function	Minimum Loss of Function
Recorded .....	17	8	0
Actual .....	4	19	2

parity in the findings shows the differences in attitudes towards function on the part of different physicians under different circumstances.

#### Summary

Questions relating to the existing level of competence in medical evaluation and prognosis have been raised. These problems were highlighted during a study of a nursing home population from the point of view of their rehabilitation potential. A method of disability evaluation is presented in an attempt to resolve several of these problems.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



Comfort and soothe the patient, even if thou art in doubt, for by that means doest thou support nature. If the patient does not follow thy directions, or if his servants and household do not carry out thy orders with dispatch or treat thee with disrespect, give up the case.

— ISAAC ISRAELI (Isaac Judeus)

# Correlation Between Fibrillation Potentials and Abnormal Chronaxies

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● This study was carried out in patients with diffuse peripheral neuropathies, nerve injuries, anterior horn involvement, and myopathies. The total number of muscles investigated was 1,665. There is a high percentage of muscles showing fibrillation potentials when the chronaxie is above 20 milliseconds. The frequency of occurrence of fibrillation potentials markedly decreases for muscles with chronaxies below 20 milliseconds, and only 20-35 per cent of muscles with abnormal chronaxies of 1-3 milliseconds were found to be fibrillating. Almost the same percentage of fibrillating potentials was found for muscles with normal chronaxies in patients presenting lower motor neuron disturbances. These results are discussed.

Electromyography has been used increasingly in the diagnosis of neurogenic and myogenic disorders.<sup>1-5</sup> Its contributions to the study of nerve regeneration, muscle dystrophies, myotonias, myasthenias, and discogenic disorders, as well as the investigation of nerve conduction velocity and the patterns of voluntary movements, can hardly be duplicated by any other electrophysiologic procedure. In the analysis of the activity of denervated muscles, the recording of fibrillation potentials, positive sharp waves, and other abnormal electromyographic patterns has been found to be of great clinical significance. There has been, however, a trend to discard other electrodiagnostic methods, including the chronaximeter, in favor of exclusive use of electromyography. This is all the more unfortunate because of the many instances of false negative electromyograms of the denervated muscles. A joint use of electrodiagnostic methods by stimulation and by recording seems to be desirable. The present paper contributes to the evaluation of such a combined examination. Moreover, it suggests the possibility of using other electrodiagnostic criteria evolved from a concomitant nerve stimulation and muscle recording.

## Population, Methods, and Definitions

**Population.** Table 1 shows the distribution of diagnoses in 101 examined patients. In addition to the patients with focal nerve injuries and diffuse neuro-

pathies (alcoholic and diabetic), patients with anterior horn diseases (poliomyelitis and progressive spinal atrophy), as well as those with muscle dystrophies, were studied. The total number of muscles examined was 1,620.

**Method.** A constant-current chronaximeter (Teca) and a three-channel electromyograph (Disa) were used. Skin electrodes were employed for stimulation at motor points. Coaxial needle electrodes were inserted into the muscles for recording muscle potentials. For simultaneous nerve stimulation and muscle recording, a Grass physiological stimulator was used with an isolation unit. One millisecond square waves were applied at a frequency of one per second. A photographic recording of the electromyograms was made in all cases with a paper speed of one meter per second.

**Definitions.** Fibrillation potentials were defined as spikes of less than 2 msec. duration, spontaneously occurring in a resting muscle. The chronaxies were considered as definitely abnormal when they were over 1 msec., with the exception of hamstrings and the extensor hallucis longus, for which the upper limit of 3 msec. was accepted as the normal limits.

## Results

**Incidence of Fibrillation Potentials.** Table 2 summarizes the results obtained during this study. In patients with diffuse neuropathies, when the chronaxie is increased beyond 20 msec., practically all the examined muscles fibrillate. However, when the chronaxie increase is not as extreme and yet shows a considerable abnormality (10 to 20 msec.), only two thirds of the muscles fibrillate. In these

Read at the Thirty-seventh Annual Session of the American Congress of Physical Medicine and Rehabilitation, Minneapolis, September 3, 1959.  
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Table 1: Distribution of Diagnoses

	No. of Patients	No. of Muscles
Diffuse neuropathies .....	54	1,169
Alcoholic .....	37	
Diabetic .....	17	
Nerve injuries .....	36	173
Ulnar .....	11	
Peroneal .....	7	
Radial .....	5	
Facial .....	4	
Other .....	9	
Anterior horn involvement ..	5	59
Poliomyelitis .....	2	
Progressive muscular atrophy .....	3	
Myopathies .....	6	219
Muscular dystrophy .....	3	
Myotonia dystrophica .....	3	
Total .....	101	1,620

patients, only a third of the muscles presenting a moderate increase of chronaxies (3 to 9 msec.) and only a fifth of muscles showing a slight increase of chronaxie fibrillated. It is interesting to note that 13 per cent of muscles with normal chronaxies also fibrillate in these patients. In patients with nerve injuries, fibrillations are found in a higher percentage of cases (80-95 per cent for muscles with chronaxies above 3 msec.). However, again fibrillations were found in the same proportion of cases (about a third of the muscles) whether the chronaxie was slightly increased or normal. In patients with anterior horn involvement, the percentage of fibrillation potentials is lower. It is observed in approximately one half to two thirds of the muscles with chronaxies above 10 msec., and in about one fifth to one fourth of the cases with chronaxies below 3 msec. (either normal or abnormal). Finally, in patients with myopathies, no chronaxies above 10 msec. were found, and fibrillations were

observed in half of the muscles with chronaxies between 3 and 10 msec. and in one fifth of the muscles with chronaxies below 3 msec.

#### Comments

The foregoing findings, although demonstrating a definite correlation between the presence of abnormal chronaxies and the incidence of fibrillations, show that the occurrence of the one does not necessarily imply the presence of the other. Clearly, in some cases electromyography fails to detect denervation that is revealed by chronaxie; the converse also is true. This suggests the advisability of joint use of both methods, unless one of them gives a complete clue to the diagnosis and localization of the lesion.

The reasons for deficiency of each of these methods will be examined with the expectation of furthering the development of the present methodology.

*Direct Myography Associated with Chronaximetry.* A common misconception

Table 2: Fibrillations in Per Cent Chronaxies

	>30 Msec.			20-29 Msec.			10-19 Msec.			3-9 Msec.			1-3 Msec.			<1 Msec.		
	F	N	%	F	N	%	F	N	%	F	N	%	F	N	%	F	N	%
Neuropathies	9	1	90.0	10	1	90.9	11	6	64.7	19	27	33.9	16	68	19.0	133	868	13.3
Nerve injuries	23	1	95.8	12	3	80.0	14	3	82.3	24	6	80.0	8	15	34.8	23	41	35.9
Anterior Horn involvement	1	1	50.0	5	3	62.5	6	7	46.1	..	7	0.0	3	6	33.3	4	16	20.0
Myopathies ..	..	..	..	..	..	..	..	..	..	4	4	50.0	2	9	15.1	44	156	22.0

F=Number of muscles with fibrillation potentials.

N=Number of muscles with normal potentials.

%=Per cent of fibrillating muscles.

tion of chronaxie determinations is that a strength duration curve determination will always reveal abnormal excitability when chronaxie findings are not helpful. As figure 1 shows, a partially denervated muscle may be characterized by the presence of several excitable tissues—the normal muscle fibers and the abnormal ones showing a gamut of different degrees of abnormality. In order to simplify this discussion, let us consider only two kinds of fibers: normal and abnormal.

Strength duration curve *B* represents normal fibers, and the horizontal line below illustrates the corresponding chronaxie. Strength duration curve *A* represents abnormal fibers with a rheobase above that of normal fibers. As only the threshold voltages are determined in plotting a strength duration curve, it is clear from this figure that the entire curve *A* will be ignored by the examiner and the corresponding chronaxie will not be determined. The same will occur if the rheobase of the abnormal fibers is equal to that of the normal ones. The chronaxie that will be determined will

be within the normal limits (horizontal line *B*). This explains the occurrence of false negatives during the chronaxie examination. Fortunately, in most instances the rheobase of the abnormal fibers is below that of the normal ones, as is curve *C*. In such a case, a characteristic complex strength duration curve appears represented by interrupted lines *BC*. The chronaxie thus determined is false as it does not correspond to the double of the rheobase determined for the abnormal fibers, the normal part of the muscle having the lowest threshold voltage in this region of the pulse duration. In other words, the abnormal excitability is masked by the presence of normal fibers. Yet, in spite of this, even a false chronaxie is usually larger than the normal one and, therefore, is diagnostic.

To unmask the abnormal excitability, progressive currents<sup>6</sup> or longitudinal stimulation may be used. Another method would be to record the contractions of the muscle while determining their chronaxie. Since abnormal fibers have a slow contraction (or decontraction), they are labeled, so to speak, by the disease process. By stimulating the muscle with increasing intensities of the current for each pulse duration, and simultaneously recording the contraction, the investigator may detect threshold slow twitches and thus determine the correct chronaxie. An isometric stimulating myograph, such as the one described previously<sup>7</sup> can be used. An attempt to determine normal values of durations of contractions of human muscles was made previously and the effect of temperature investigated.<sup>8-9</sup>

**Activated Electromyograms.** The reason for the failure of fibrillations to appear in certain cases of denervation are not entirely clear. Often the needle electrode does not reach the involved part of the muscle. In order to increase the usefulness of electromyographic examinations, determination of the conduction times is becoming a routine practice.<sup>2</sup> The examiner usually applies skin electrodes that detect an envelope of the electrical responses of the muscles. It is easy to show that the use of the

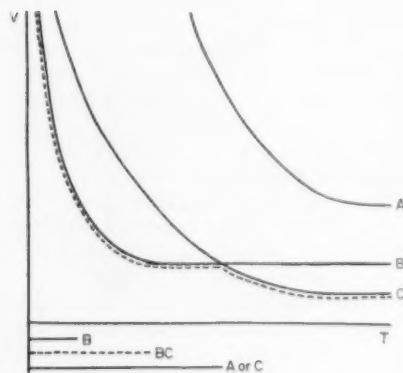


Fig. 1—Presence of false chronaxies in a partially denervated muscle. Strength duration curves (A and C) show abnormal slow excitability in denervated portion of the muscle. In A, the rheobase is higher; in C, the rheobase is lower than that of the normal portion of the muscle. The strength duration curve (B) corresponds to the normal portion of the muscle. The horizontal lines show the duration of chronaxies in A, B, or C if fibers were explored independently. The horizontal line BC shows the false chronaxie in the partially denervated muscle when the rheobase of abnormal fibers is below that of the rheobase of normal ones. If the rheobase from abnormal fibers is equal or above that of normal fibers, the abnormal chronaxie cannot be determined in the involved muscle.

needle electrodes may considerably extend the applicability of this method for the diagnosis of muscle abnormalities.

Stimulation of the motor nerves with simultaneous recording of evoked potentials in the corresponding muscles was carried out in a great number of normal individuals and patients, with the supra-maximal intensity of the stimulus (1 msec. square wave pulse). Complex waves were often recorded in both normal and abnormal muscles. However, while in the normal muscles the components of the complex waves were relatively slow, in the muscles with partial reaction of degeneration and in certain myopathies a shower of brief spikes often was observed.

Figure 2 shows electromyograms in one normal individual and in two patients with partial reaction of degeneration, the complex potentials induced by the stimulation of the corresponding motor nerve. In abnormal muscles, sharp potentials of 1-2 msec. duration were induced. Usually with stimulation of the medial and ulnar nerve at the wrist and peroneal nerve at the knee, the burst of spikes appears about 10 msec. after the stimulus and persists for about 10 msec. This phenomenon is not observed in all patients, but could be recorded in a great variety of abnormal muscles.

The explanation of the induction of brief spikes by a stimulation of the nerve supplying a partially denervated muscle might appear difficult. The difficulty is that muscles showing fibrillation potentials should not be excitable through the nerve.

The following factors may be contributory:

1. When a normal muscle is stimulated through its motor nerve with successive electrical pulses of increasing intensity, the summated potential becomes progressively more complex, even when recorded by concentric needle electrodes (fig. 2A). This may be explained both by the recruitment of muscle fibers having several loci of innervation and by possibly different conduction velocities in the nerves and in the muscles. Histologic examination of intrinsic muscles of the hand shows several conglomerations of nerve-muscle junctions.<sup>10</sup> The action potentials originating in these different junctions travel relatively slowly.<sup>1</sup> The presence of three different peaks on the trace in figure 2A may result from the presence of three different conglomerations of nerve-muscle plates located at different distances from the recording electrodes, or three different conduction velocities in the nerve fibers themselves, or both.

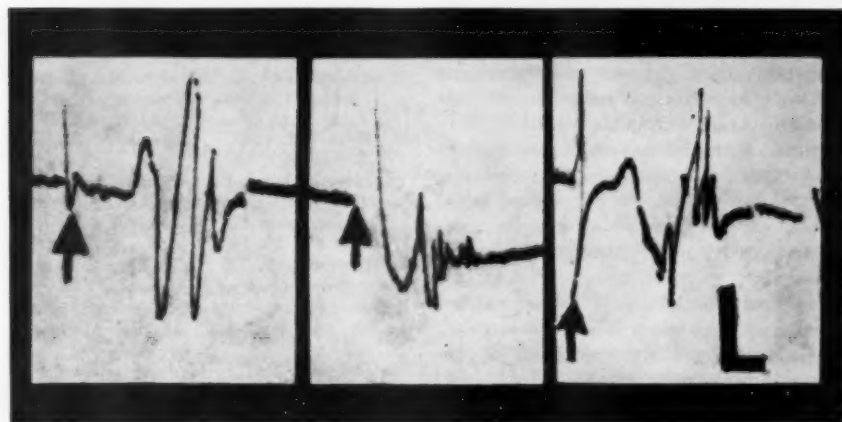


Fig. 2 — A (left), The complex potential evoked by the stimulation of the median nerve at the elbow and recorded in the abductor pollicis brevis in a normal individual. B (middle), Stimulation of the peroneal nerve and recording in the peroneus longus in a patient with peroneal palsy. C (right), Stimulation of the ulnar nerve in the wrist and recording in the abductor digiti quinti.

Vertical line, 0.5 mv.; horizontal line, 5 msec.; arrow, stimulus artifact.



In partial degeneration, the breakdown of the summated potentials, in a burst of brief spikes, could be explained in the following way: great discrepancies in conduction velocities might exist in the proximal and terminal intramuscular nerve fibers or the muscle fibers themselves. This would explain the presence of pseudo "fibrillation potentials" despite the absence of a complete denervation.

2. The presence of a repetitive response of the partially involved units is a less likely but possible explanation.

3. A secondary burst of fibrillation potentials induced by mechanical or possibly biochemical activation of neighboring denervated fibers is another alternative. Repeating stimulation of the nerve may induce fibrillation. However, the phenomena represented in figure 2B and C occur before the full development of muscle twitch.

Further investigations are in progress to better understand these findings which may be of practical significance for further development of clinical electromyography.

#### Summary

The presence of abnormal chronaxies is correlated to the incidence of fibrillation potentials in both peripheral neuropathies and muscular dystrophies. In extremely increased chronaxies, fibrillations are practically always observed. However, in more than half of the muscles showing only slightly or moderately increased chronaxies, fibrillations are not present. Conversely, in some muscles of patients with diffuse peripheral neuropathies or focal nerve injuries showing normal chronaxies, fibrillations are present. Combined electromyography and chronaximetry are, therefore, recommended.

The presence of false negative chronaxies may be explained in certain cases by the masking of the excitability of abnormal fibers by that of the normal ones. Direct myography may correct this source of errors.

Stimulation of a nerve supplying a partially denervated or diseased muscle may induce a shower of brief spikes below 2 msec. duration. These spikes may result from the increased differences in conduction velocities among the proximal and terminal nerve fibers or the muscle fibers themselves due to the disease process.

The presence of multiphasic response to a nerve volley in normal muscles may be caused either by differences of conduction velocity in the nerve and muscle fibers or by the multiple loci of innervation of the muscle, or both.

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# Heterotopic Ossification, a Problem in Rehabilitation Medicine

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● Extraskeletal bone formation may complicate a number of disabling diseases and may interfere with rehabilitation procedures. As an example, some problems arising from periarticular ossification in spinal cord diseases are discussed. The occurrence of subcutaneous ossification in the legs, associated with chronic venous insufficiency, was recently described by the author. Some studies into the pathogenesis of this condition are discussed, insofar as they may help to clarify the understanding of extraskeletal ossification elsewhere.

Extraskeletal bone formation in man is encountered in various conditions<sup>1-4</sup> and may interfere with rehabilitation. Periarticular bone may form in spinal cord injuries and in poliomyelitis and may severely limit the range of motion of major joints. Most frequently, hip, knee, elbow and shoulder joints are involved. Attempts at removal of such abnormal bone have not been too successful. New bone has formed in the operated area and infections have prevented healing. Functional results have been modest.<sup>5, 6</sup> Myositis ossificans represents another disabling disease with extraskeletal bone formation. Operated muscles often do not regain satisfactory function.

## Some Theories of Pathogenesis

The nature of heterotopic ossification is poorly understood. Many hypotheses have been formulated to explain its pathogenesis. Leriche and Policard<sup>7</sup> proposed that, in paraplegics, faulty sympathetic vasoconstrictor control caused osteoporosis by vastly increasing articular blood flow; at the same time, either periarticular trauma or necrosis, hematoma, inflammation or infection would cause periarticular tissue to revert to the embryologically earlier function of osteogenesis. An increased supply of calcium salts would thus be available in the vicinity of a bone matrix and periarticular bone would form. This rather elaborate and largely unsupported hypothesis synthesized various earlier theories. These concerned reversion of connective tissue to earlier mesenchymal function after denervation,<sup>8</sup> osteogenic stimulation of

inflammation,<sup>9</sup> tissue hematoma<sup>10</sup> or the presence of calcium salts.<sup>11</sup> It would exceed the scope of this paper to mention other proposed theories of the pathogenesis of heterotopic ossification.

Dejerine, Ceillier, and Dejerine,<sup>12</sup> in the original paper on heterotopic ossification in spinal cord injuries (1919) concluded from study of their pathologic material that, among other things, periarticular edema and inflammation were somehow related to periarticular bone formation. This observation has been, with some exception,<sup>5</sup> ignored in the literature. The association of such ossification with local edema was of particular interest to me. In the past ten years, we have observed a hitherto unrecognized form of this condition which is clearly linked with chronic tissue edema.

In late stages of chronic venous insufficiency (tissue damage due to abnormalities in venous blood flow<sup>13</sup>) subcutaneous bone formation in the involved legs is common, though not always easily recognized.<sup>14</sup> We have observed more than 150 cases. In some cases, large bone shields surround both legs; in others, tiny bone plates are palpated and are difficult to detect even roentgenographically. In most cases, clinical and roentgenographic findings are quite distinctive. The condition in itself presents some problems in rehabilitation management.<sup>15</sup> In most cases, the process of subcutaneous ossification is completed when the patient is first seen. Thus far, only in three cases has ossification appeared to be progressive during examination and follow-up period. In these cases, local edema appeared to play a role in the formation of subcutaneous bone.

Read at the Thirty-seventh Annual Session of the American Congress of Physical Medicine and Rehabilitation, Minneapolis, September 3, 1959.

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### Case Reports and Discussion

*Case 1.* A 52-year-old woman was first seen in April, 1955. She had a 25-year history of bilateral varicosities and ilio-femoral thrombophlebitis on the left side. A large, recurrent, painful ulcer of the left leg had been present for nine years. In December, 1955, ulcer and underlying subcutis with osseous plaques measuring 3 by 4 inches were removed and the uninvolved muscle fascia covered with a split-thickness skin graft; multiple vein ligations were performed. Distally and proximally, subcutaneous bone plaques were left behind. In late 1957, valvular insufficiency recurred in a perforator vein underneath the proximal part of the skin graft, producing edema and ulceration near the proximal edge of the graft and in the skin proximal to it; in the latter area, some new bone plaques could be seen roentgenographically. No new ones developed distally where no edema was present.

In November, 1958, the edematous and ulcerated area measuring 3 by 3 inches was excised and covered with a split-thickness skin graft. The perforator vein was ligated and some remaining large varicosities were subsequently treated with sclerosing injections. Today there is no edema, no new bone formation and the leg remains healed. In summing up, subcutaneous bone formation was observed only in area of local edema.

Ground substance was found by histopathologic examination at the site of bone formation in chronically inflamed fat tissue.<sup>16</sup> The collagen appeared to represent a fibroblastic product originating from protein laid down in the protein-rich local edema fluid of long standing.

These clinical and pathologic impressions may reflect a more general mechanism of extraskeletal bone formation in man.

Both normal and heterotopic bone in man contain calcium phosphate in hydroxyapatite crystals (or in one of the more hydrated moieties)<sup>17</sup> quite constantly. Many theories have evolved concerning the mechanism of the laying down of bone crystals in bone matrix. These can be broadly categorized in two

concepts: (1) "booster" theories propose that inorganic phosphates are made available from organic substrates by enzymatic action,<sup>18, 19</sup> (2) the organic matrix itself initiates the formation of bone crystals.<sup>20</sup> Each of these concepts has been expressed in a number of theories and these have been corroborated with a host of pertinent observations, but an over-all valid theory of ossification has not yet been formulated.

Nageotte<sup>21</sup> and many subsequent investigators have shown that a collagen displaying the chemical and physical characteristics of bone collagen could be prepared in vitro from collagen derived from several sources. Glimcher<sup>17</sup> recently demonstrated that collagen able to initiate crystallization of hydroxyapatite inside the fiber (as it happens in bone) from metastable calcium phosphate solutions can be prepared in the test tube by reconstituting collagen even from non-calcifying and nonossifying tissues. He also proved that the property of collagen to initiate bone salt crystallization is inherent in the stereochemical arrangement of the individual fibers (which measure 2900 Å by 15 Å) aligned in near parallel bundles with a juxtaposition to a mean of 640 Å, while differently spaced regular, or irregular collagen fibers with the same molecular constitution are not osteogenic. Osteogenesis, therefore, starts as a physicochemical process which, at least in part, can be duplicated in the test tube under proper conditions.

This new knowledge, while admittedly incomplete to understand all phases of bone formation, might contribute to the understanding of subcutaneous ossification of the legs and (returning to Dejerine and collaborators' original observation) perhaps of periarticular ossification. Control of local edema should be included in the therapeutic rationale in either condition. In periarticular ossification, control of local edema is not easily achieved. Passive exercise appears to be ineffective.

*Case 2.* A 37-year-old woman with tuberculosis of the sixth-thoracic vertebra and with adhesive arachnoiditis and paraplegia at the level of the eighth thoracic vertebra was first seen at the end

of 1957. She was treated, among other measures, by passive range of motion in a Hubbard tank to all major joints five times weekly for eight months. Under this therapy, extraskeletal bone continued to form around both hip joints.

Abramson,<sup>22</sup> in discussing management of paraplegics to prevent periarticular ossification, noticed the frequent association of renal calculosis and periarticular ossification and believed that both are enhanced by osteoporosis which makes calcium salts available and by other manifestations of protein catabolism. He proposed that weight-bearing ambulation should be included in rehabilitation management in these cases. Our experiences with heterotopic ossification and more recent knowledge of osteogenesis, as reported, may justify the impression that local edema is an important pathogenetic factor in heterotopic ossification which may add a new rationale to early weight-bearing ambulation in the management of the paraplegic.

### Summary

Some experiences with subcutaneous ossification of the legs in chronic venous insufficiency are presented. These data and recent knowledge in experimental mineralization of collagen fibers suggest that local edema and inflammation play a pathogenetic role in heterotopic ossification, particularly in the periarticular bone formation in patients with spinal cord injuries. The rationale of prophylactic weight-bearing ambulation in these cases is discussed from the standpoint of controlling periarticular edema.

**Acknowledgments:** Dr. S. Freund operated on patient #1. Dr. L. C. Johnson (U. S. Armed Forces Institute of Pathology, Washington, D. C.), furthered the studies by his constant interest in and study of pathologic specimens.

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## Grant Award Recipient



MICHAEL KOSIAK, M.D.

The \$1,000 award offered by The R. D. Grant Company of Cleveland was won by Michael Kosiak, M.D., for his scientific study on "Etiology of Decubitus Ulcers." Dr. Kosiak was born in Chisholm, Minnesota. He was educated at the University of Minnesota, where he received his medical degree. From July, 1955 to June, 1958, he was a Fellow in Physical Medicine and Rehabilitation of the NFIP at the University of Minnesota. He is now Instructor in the Department of Physical Medicine and Rehabilitation at the University of Minnesota Medical School.

The contributions submitted were reviewed by the Program Committee of the 3rd International Congress of Physical Medicine. The papers were judged on original work, contribution to knowledge of the subject and clear exposition of the facts.

The donors of the award, The R. D. Grant Company, are makers and exclusive distributors of Alternating Pressure Point Units used to help prevent and heal decubitus ulcers.



## ★ survey of selected literature ★

This systematic abstracting and indexing of selected journals is made possible by a grant from the American Rehabilitation Foundation, a subsidiary of the Sister Elizabeth Kenny Foundation.

### ACTA PHYSIOLOGICA SCANDINAVICA. Vol. 48 (part 4), 1960.

◇ Muscle Training by Static, Concentric and Eccentric Contractions. Flemming Bonde Petersen. pp. 406-416.

Isometric strength of the elbow flexors and the knee extensors was measured by a strain-gauge dynamometer. The accuracy of the dynamometer was found to be  $\pm 1.3$  per cent.

Seventeen young female and 17 young male subjects underwent a training period of from 20 to 36 days. Their training constituted the performance of one of the following forms of exercise: One daily maximum isometric contraction; 10 daily maximum isometric contractions; 10 daily eccentric muscular contractions or 15 minutes of daily heavy dynamic work such as riding a bicycle ergometer. The effect on the isometric strength and endurance of the trained muscle groups was measured and compared to a control group of seven females and six males, who received no specific training. It was found that one daily maximum isometric contraction had no effect on the isometric strength of the muscles; 10 daily maximum isometric contractions had a tendency to increase the isometric strength of the muscles, while 10 daily maximum eccentric contractions had no measurable effect on isometric muscle strength. Heavy dynamic work increased the isometric strength of the muscles by 12 per cent in the females and 23 per cent in the males. There was no measurable effect on endurance to sustained isometric contractions consequent to any of the training programs. Training of muscles on one side did not modify the strength of the contralateral muscle groups.

◇ Intermittent Muscular Work. I. Astrand; E. H. Christensen, and R. Hedman. pp. 448-453.

The physiologic effect of rest pauses on a nonsteady state of work (2,160 kpm/min.) was studied. A physically well-trained subject performed in one hour a total amount of 64,800 kpm on a bicycle ergometer by intermittent work with 0.5, 1, 2 or 3 minute periods of work and rest. Total  $O_2$  intake, pulmonary ventilation, number of heart beats and blood lactic acid concentration during the work hour and during recovery were determined.

It was found that the heavy work when divided into short periods of work and rest (of 0.5 or 1 minutes' duration) was transformed to a submaximal load on circulation and respiration and was well tolerated during one hour. With longer periods (of 2 or 3 minutes' duration) the work output rose closely to the upper limit of performance and could be fulfilled only with the utmost strain. These findings are discussed from a physiologic and practical point of view. To explain the low lactic acid values during the short periods of work and rest it was proposed that myohemoglobin has an important function as an oxygen-store during short spells of heavy muscular work.

The influence of rest pauses on mechanical efficiency. Christensen, E. H.; R. Hedman, and I. Holmdahl. p. 443.

Myohemoglobin as an oxygen-store in man. Astrand, I.; P. O. Astrand; E. H. Christensen, and R. Hedman. p. 454.

### ★ A.M.A. ARCHIVES OF NEUROLOGY. Vol. 2, May 1960. ★

◇ Autonomous Urinary Bladder Activity in Normal Man. F. Plum. pp. 497-503.

On the basis of previous studies of feline bladders, the author feels that rhythmic contractions are an autonomous detrusor response to filling which originate independently of any reflex mechanism and contribute to normal micturition. Bladder tonus is also thought to be of a



non-neurogenic origin. Isometric cystometric studies were performed on normal males and females before and during spinal anesthesia and ganglionic blockade with tetraethylammonium (TEAC). Vesical pressure-volume curves, rhythmic contractions, micturition reflexes, and sensory thresholds were observed.

The normal control cystometrograms revealed three main responses: a fully active, consisting of rhythmic waves and reflex micturition; a partially inhibited, demonstrating rhythmic waves but no micturition reflex; and a fully inhibited, with a flat cystometric curve, demonstrating neither rhythmic waves nor reflex micturition. All subjects had similar cystometric thresholds for filling sensation. Rhythmic activity preceded reflex micturition, if the latter occurred, and commenced at a fluid threshold of from 175-400 cc. Overdistention inhibited rhythmic contractions and if continued, the contractions ceased. Repeat cystometry immediately following this revealed absence of rhythmic activity and again immediately repeating the cystometrograms under spinal anesthesia produced a low, flat curve. Five days later, however, both rhythmic activity and tonus returned. Spinal anesthesia produced a loss of vesical sensation and micturition reflexes, but tone and bladder rhythmicity, if not inhibited by previous overdistention, were not lost. Tetraethylammonium chloride, 300 mg. administered intravenously, also failed to alter these functions and the stretch reflex remained intact.

In conclusion, the author feels that tonus and rhythmic contractions in man are of a non-neurogenic origin and are thus inherent bladder wall function. Only sensation and reflex micturition depend upon central innervation. Accordingly, both atonic and hypertonic bladders have a non-neurogenic origin and after distention and infection have altered the physical properties of the bladder wall it is almost impossible to distinguish cystometrically between the two.

◇ Ischemic Degeneration of Nerve Fibers. M. J. Blunt. pp. 528-535.

A group of experiments were performed to determine the importance of regional vasa nervorum in the maintenance of nerve fibers. Sciatic nerves of rabbits were used for two main groups of experiments. In the first group, the nerve was carefully exposed and devascularized, except for the epineural and the intraneural vascular plexuses, proximal and distal to the devascularization. It was then replaced into its original muscle bed. No functional impairment was noted in these cases and only one out of the four rabbits showed a few scattered fibers in a state of degeneration on histological examination. The other experiment consisted of ensheathing the devascularized nerve with polyethylene before replacing it in the muscle bed. This eliminated the effect of diffusion of nutrients from surrounding well-vascularized tissues. Here extensive functional and structural changes were produced in all but one of the eight experiments performed.

It is believed that in small nerve trunks, such as the sciatic nerve in rabbits, the nutrition of the nerve may be maintained by diffusion from surrounding tissues after occlusion of the vasa nervorum. The author feels, however, that the diffusion would probably be insufficient to maintain the greater nutrient needs of the large nerve trunks of man. Subsidiary control experiments were also performed. One group, in which the nerve was ensheathed along with its blood supply, did not show nerve degeneration. Other experiments, including actual nerve crush and ligation of the nerve and all but a minor part of its blood supply, revealed degeneration.

The genesis of vesical rhythmicity. Plum, F., and R. H. Colfelt. p. 487.



A.M.A. ARCHIVES OF PATHOLOGY. Vol. 69, Jan. 1960.

◇ Geriatric Pathology. R. M. Mulligan. pp. 1-34.

Autopsies were performed on 356 persons 80 years of age and older at the Colorado General Hospital between 1940 and 1955. A detailed account of the causes of death, associated diseases, and contributing causes of death was made and this was compared with previously published accounts of large series of autopsies on cases of similar ages. The greater incidence of cancer in the present study (approximately 4%) as compared with the older studies constituted the main difference.

The principle causes of death in the 356 cases were cardiovascular disease, 132; cancer, 58; infection, 44; accident, 43; nodular hyperplasia of the prostate, 29; alimentary tract diseases, 20; diabetes mellitus, six; nervous system diseases, two; respiratory tract diseases, two, and unsatisfactory cases, 20. Of the 132 cases of cardiovascular disease 66 were of essential hypertension, 22 of arteriosclerosis of coronary arteries, nine of arteriosclerosis of cerebral arteries, seven cases of amyloidosis of the heart, two of congenital aneurysm of the cerebral arteries. Most of the infections were bronchopneumonias; there were only two cases of decubital

(pressure) ulcers severe enough to be fatal. Of the 43 accidents, 31 were femoral fractures. In the case of nodular hyperplasia of the prostate, almost all were in the lateral lobes. Six cases had clinical uremia and 27 cases had genitourinary infection. In the six cases of diabetes mellitus all expired of the effects of arteriosclerosis.

◇ **Myocardial Infarction in Man and Experimental Animals.** W. A. Thomas; W. S. Hartford, and R. M. O'Neal. pp. 104-109.

The authors submit the hypothesis that most instances of coronary thrombosis involve the well-known local factor (atherosclerosis) and a hematological factor (antifibrinolytic or pro-coagulative or both). Support for this hypothesis rests on a number of factors such as many more persons with advanced atherosclerosis come to autopsy without occlusive thrombosis than with it. It is not uncommon to find coronary thrombosis in the presence of relatively mild atherosclerosis.

To substantiate this thesis the authors working with rats (and reminding us how very unusual is arterial thrombosis and infarct in experimental animals fed diets producing arteriosclerosis) caused the development of the local factor by feeding a cholesterol-thiouracil regimen and the hematological factor by feeding large quantities of butter or lard or other saturated fats. Rats thus fed developed arterial thromboses with myocardial and renal infarction with significant frequency (over 20%). The infarcts and thrombi were similar in every respect to those in man. Usually, however, the thrombi developed before actual plaque formation occurred, suggesting the primary importance of the hematological factor.

◇ **Heterotopic ossification and dystrophic calcification in infarcted rat kidney.** Gruhn, J., and E. R. Fisher. p. 82.

◇ **Intercranial involvement from carcinoma of the lung.** Halpert, B.; E. E. Erickson, and W. S. Fields. p. 93.



## **A.M.A. ARCHIVES OF PATHOLOGY. Vol. 69, Feb. 1960.**

◇ **The Size of Muscle Fibers in Infants and Children.** D. H. Bowden, and R. A. Goyer. pp. 188-189.

Measurements of the diameter of muscle fibers in exact cross section were made of various muscles obtained at autopsy on infants and children from prematurity to nine years of age. Zenker's fixative and hematoxylin and eosin were used. It is to be remembered that the normal adult deltoid muscle fiber varies from 46 to 63 microns in diameter. In comparison this study revealed that the deltoid fibers from prematurity to age 9 varied from 5.9 to 23.8 microns.

Overall results of this study suggest that the size of skeletal muscle fibers is directly related to function. In the fetus the fibers of the various muscles closely approximate each other in size, but by the time of birth the growth of the diaphragm has outstripped that of all other striated muscles. Respiration, the only significant activity of skeletal muscle in the neonatal period, is predominantly diaphragmatic in nature, and the fibers of the diaphragm are almost twice the diameter of the intercostal and limb muscles. As voluntary movements increase during the first year, so the locomotor muscles enlarge, until they approximate the size of the respiratory muscles. Thereafter, these muscles are composed of fibers of similar size, whereas the delicate extrinsic muscles of the eye are very little larger than they are at birth. The newborn superior rectus averages 8.6 microns; the same muscle in the 6½ year old child averages 10.6 microns. The gastrocnemius measures 6.2 microns at birth and 29.1 microns at nine years of age.

◇ **Pathogenesis of Small Cerebral Infarcts.** W. J. Winter, and E. Gyori. pp. 224-234.

The authors support the group believing that every infarct of the brain is due to occlusion of related vessels and that studies which do not support this concept have not been sufficiently careful; and as opposed to that group which implies that infarcts of the brain may be due to vasospasm, vasoparalysis, and vasocongestion — phenomena which cannot be properly assessed with a microscope.

In a series of 21 brains with infarcts in areas supplied by small vessels, definite vascular lesions were found in all but two cases, in which, the authors believe, lesions were overlooked, despite painstaking dissection. Fresh thrombi or emboli were found in the "supply" arteries of recent infarcts. These were sometimes superimposed upon preexisting atheromata or occurred at medial defects in the arterial wall; they did not always completely occlude the lumen of the artery. In older infarcts the lumen of the associated arteries was either occluded or narrowed by fibrous lesions. In nonoccluded vessels these appeared as eccentric plaques. The majority of

these lesions, at least, are believed to be organized thrombi. The nonocclusive nature of some of these thrombi indicates that cortical infarcts may occur without complete ischemia. This study, then, gives positive support to the widely held concept that small cerebral infarcts are due to occlusive or stenosing vascular lesions that may only be found after prolonged and careful search.

**Histologic alterations in muscles of guinea pigs during chronic hypoxia.** *Valdivia, E.; M. Watson, and C. M. S. Dass.* p. 199.

**Proliferative myositis; a pseudosarcomatous reaction to injury.** *Kern, W. H.* p. 209.



## A.M.A. ARCHIVES OF PATHOLOGY. Vol. 69, Mar. 1960.

◇ **Stimulation of Granulation Tissue Growth by Tissue Extracts.** *R. H. Edwards; S. S. Sarmenta, and G. M. Hass.* pp. 286-302.

In order to test the growth promoting properties of three different tissue extracts on granulation tissue, tiny polyvinyl sponges saturated with one or another of the extracts were implanted in the back muscles of one side of 60 rabbits. On the other side in each rabbit identical sponges soaked in a plasma solution only were implanted to serve as controls. This technic is said to obviate such difficulties as wound contraction, variable epithelialization, surface infection and the vagaries involved in measuring tensile strength of healing wounds. The three tissue extracts used to prepare the experimental sponges were either eight-day chick embryo extract; autologous spleen extract, or autologous granulation tissue extract (from thigh muscles five days after crushing). The extracts were mixed with plasma and Tyrode's solution to obtain optimum media. Tyrode's solution was also used to dilute the plasma used in the control sponges.

At periods ranging from two to 21 days after implantation, histologic studies were made of the granulation tissue growing into the pores of the sponges from the surrounding muscles. At all comparable time intervals there were more fibroblasts and deeper penetration in the experimental sponges as compared with the controls. In addition all components of granulation tissue including capillaries accompanied the fibroblastic invasion. There was also increased rate of maturation of collagenous fibrils in the experimental sponges. A mild Arthus phenomenon was observed with the chick embryo extract. Thus it was possible to increase the rate of fibroblastic proliferation, capillary formation, and maturation of newly formed collagen in granulation tissue growing into a closed plasma clot system within a wound by addition of tissue extracts.

◇ **The Fine Structure of the Glomerulus in Amyloidosis.** *H. Z. Movat.* pp. 323-332.

Three patients with amyloidosis (two primary and one secondary) were subjected to needle biopsy of the kidney with the specific purpose of examining the sections with particular reference to the basement membrane of the glomerulus. This was done to elucidate the exact nature and site of the amyloid change and its relation to the basement membrane, since two different theories prevail as to the mode of development of amyloid in the glomerulus. One school postulates that the amyloid is a deposit located next to the basement membrane, while the other holds that amyloidosis of the glomerulus is an intrinsic alteration or degeneration of the basement membrane itself.

By light microscopy an intact basement membrane was seen with amyloid on either side of it. The electron microphotographs showed that the basement membrane remained intact while the amyloid was deposited between the endothelium and basement membrane and/or between the basement membrane and the glomerular epithelium. These findings indicate that amyloid is not an intrinsic alteration or degeneration of the basement membrane, but rather a deposit. The author's view is that amyloid is a hematogenous, proteinaceous material, containing globulin, deposited in and between connective tissue.

**Brain lesions in chronic alcoholism.** *Lynch, M. J. G.* p. 342.



## A.M.A. ARCHIVES OF PATHOLOGY. Vol. 69, April 1960.

◇ **Cerebral Vascular Lesions and Peptic Ulceration.** *J. B. Dalgaard.* pp. 359-370.

This report from Denmark is devoted to the analysis of concomitant vascular lesions of the brain and ulceration of the stomach in 100 out of 4,317 autopsies. In a number of previous papers the author described upper digestive tract lesions associated with cerebral injuries, tumors, operations and infections.

In order to justify the cause and effect relationship between these two conditions the author relies heavily on a rough statistical presentation since there is a high incidence of both. Nearly one-third of the cases with acute peptic ulceration had cerebral vascular lesions, whereas less than one-fifth with chronic ulcers had such lesions. It should be noted that there were 385 cases of peptic ulcer altogether in this large series, 208 acute and 177 chronic. Roughly one-eighth of the total number of cases had cerebrovascular lesions. This 8 to 3 preponderance convinces the author that such lesions are the most common single cause of acute peptic ulceration encountered at postmortem. It is interesting to note that nearly all of these acute neurogenic peptic ulcer patients expired in less than ten days after the stroke and a clinical diagnosis of gastroduodenal ulceration or perforation was rarely made even when such condition was an immediate or contributing cause of death.

◇ **The Mechanism of Cerebral Contusions.** R. Lindenberg, and E. Freytag. pp. 440-469.

This rather long and complex report concerning the mechanisms of cerebral contusions is based on fact and theory gleaned from the literature and on selected cases from more than 900 fatal head injuries. The injuries were grouped in three categories: blows to the head, falls, in which the head struck an object of high inertia, and lastly blows to the head where the latter was supported firmly by an object of high inertia.

In blows to the head indentation of the skull at the site of impact, and positive pressure at the same site due to the greater acceleration of the less massive skull as compared with the brain results in coup lesions almost exclusively. The negative but analogous pressure on the other side neutralizes the effect of brain displacement resulting from the blow and accounts for the rarity of contrecoup lesions in blows to the head. When the head strikes an "immovable body" the acceleration of the head as it falls causes negative pressure between the brain and the skull in the area of expected impact and positive pressure on the other side. Shifting of the cerebrospinal fluid occurs in obedience to the pressure changes with the result that the layer of fluid is thicker at the "leading edge" and very scanty in the area opposite the site of expected impact. Thus the brain is cushioned where the head will strike, but is left vulnerable to the pressure of skull deformation on the opposite side, and accordingly there is produced a great preponderance of contrecoup lesions in the second class of head injuries. In the third category of injury, cases of a blow to the supported head, brain damage is less severe and coup and contrecoup lesions are rare unless the blow is a crushing one. Large intracranial pressures may be generated by the transient deformation of the skull, but the absorption of much of the force by the supporting object and the absence of appreciable acceleration of the brain and skull reduce or at least do not contribute to the damaging effects of the pressure.

Antagonistic effects of parathyroid extract and cortisone. Bradford, R. H.; R. P. Howard; W. Joel, and M. R. Shetlar. p. 382.

Histopathology of amino acid deficiencies. Scott, E. B. p. 390.



## A.M.A. ARCHIVES OF PATHOLOGY. Vol. 69, May 1960.

◇ **Ischemic Infarction and Swelling in the Rat Brain.** S. Levine, and M. Klein. pp. 544-553.

An experimental model for the study of the effects of interference with the blood supply to the brain was provided by subjecting 200 rats to ligation of both common carotid arteries. Death ensued in a day or less in over 60 per cent of the animals. Those that survived were sacrificed at periods ranging from two to six days. The intracranial contents of all of the animals were examined and ischemic infarction and swelling dominated the pathological picture except in that group of asymptomatic survivors whose brains appeared normal.

The extent and locus of the lesions varied markedly; necrosis was mainly unilateral and rarely massive, while swelling tended to be generalized and bilateral.

Of 46 of the 200 animals, one-half were provided an air-conditioned environment postoperatively, which appeared to raise the survival rate a very striking 600 per cent by its favorable effect on body temperature. An elevation of body temperature was generally noted in the control animals, whereas a fall up to four degrees occurred in the others. The higher survival rate is attributed to reduced metabolic activity of the brain at lower temperatures during that critical phase when the transition to collateral circulation occurs. It is worth emphasizing that 37 out of the 200 animals showed no ill effects nor discernible brain damage. In summary then the potential importance of temperature-humidity factors in vascular insults to the brain is stressed and the variability and vital role of collateral circulation is demonstrated.

Bronchiolar emphysema of the lungs. Ravines, H. T. p. 554.



**THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES.**

Vol. 239, Jan. 1960.

◇ **Studies on Growth Hormone: V. Effect on the Mineral and Nitrogen Balances of Burned Patients.** Elinor Pearson; H. S. Soroff; J. F. Prudden, and M. S. Schwartz. pp. 17-25.

The present study was an outgrowth of previous work by the authors on the influence of growth hormone (GH) on the nitrogen balance in burn patients. From the prior study it had been learned that an increase in the nitrogen uptake during GH administration occurred only in the presence of nitrogen intake above 10 g/square meter/day. In the work currently reported, balance studies on N, P, K, Na, Ca and Mg were carried out.

Four severely burned patients were studied starting 18, 47, 86 and 127 days post burn. The patients then were studied daily for periods ranging from 60 to 160 days. In general the study periods alternated with 5 days on and 5 days off GH treatment. Daily doses of 150 to 200 mg. of bovine GH extract were given intramuscularly during the treatment periods.

It was shown frequently in each patient that the potassium balance was more positive than would be expected from the concurrent nitrogen balance. This indicated that potassium (and also phosphorus) were preferentially retained.

Statistical analysis of the data were employed to allow comparison of the non-GH and GH periods in the presence of varying *ad libitum* intake. Paralleling the previous finding for nitrogen, it was learned that when GH was given an increase in potassium uptake depended on an adequate potassium intake. Thus there was a critical level of potassium intake above which the uptake was enhanced and below which it was decreased in respect to uptake levels occurring in the absence of GH.

With the other minerals studied, parallel, though less consistent, results were noted due to GH therapy. For calcium, phosphorus and magnesium, the results suggested the potassium-like effect of GH, though for these elements the present data do not permit firm conclusions. Sodium and chloride retention was decreased during periods of GH administration.

◇ **Studies on Growth Hormone: VI. Dependence of Anabolism on the Level of Intake.** F. E. Gump; M. S. Schwartz, and J. F. Prudden. pp. 27-32.

The authors report a study of the effect of bovine growth hormone (GH) on the weight changes of experimentally burned rats during recovery. Sherman strain rats, 13 weeks old, were burned over a 28 cm.<sup>2</sup> area. Third degree burns were produced. Daily thereafter each animal in the experimental group received 4 mg. of GH in saline by intramuscular injection. Control animals were given saline only. All animals were allowed unlimited access to food and water for two weeks following the burn. For 10 days thereafter, no food was given any of the animals.

The results indicated that anabolism was enhanced in the GH treated group in direct proportion to the food intake. Whereas the control group showed weight loss early in recovery, the weight gain of the treated animals was hardly affected by the trauma. During the starvation phase of the experiment, the GH treated animals lost weight more rapidly than the controls.

The authors point out the similarity in the findings of this study and of the study of the recovery of burned human patients as influenced by GH administration. In both cases the enhancement of anabolic activity by growth hormone is critically dependent upon high levels of caloric intake.

**Medicine — the waning joint (progress of medical science section).** Jeffrey, M. R. p. 104.

**THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES.**

Vol. 239, Feb. 1960.

◇ **Variations in Serum Lipid Concentration and Clinical Coronary Disease.** M. E. Groover, Jr.; J. A. Jernigan, and C. D. Martin. pp. 133-139.

In this paper the authors are reporting further observations made under the executive health program of the United States Air Force. Repeated serum cholesterol determinations (six a year for five years) had been made on 177 men of ages 40-60. The results of this investigation form the basis of the current report. Statistical study of the cholesterol levels in relation to clinical coronary disease revealed no significant relation between the levels *per se* and the frequency of disease.



However, the 16 cases of myocardial infarction occurred in the group that showed large variations in serum levels of cholesterol. In this group the variation was 25 per cent or more above the five year average. The data show that the attacks usually occurred immediately following or within a period of temporary elevation of serum cholesterol.

The authors report the inadequacy of out-patient treatment in attempts to stabilize the apparently dangerous temporary elevation of cholesterol. They found it frequently necessary to hospitalize patients developing this symptom.

The hypnotic effect of a new propanediol dicarbamate, W583. Bodi, T.; H. A. Levy; J. H. Hodine, and J. H. Moyer. p. 207.



## THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

Vol. 239, Mar. 1960.

◇ Vibratory Sense and Oscillometric Index in Gout and in Rheumatoid Arthritis. T. S. Danowski; C. Moses, Jr., and H. M. Margolis. pp. 295-300.

The authors have investigated the perception of vibration and the pulse pressure in the extremities of patients with gout and rheumatoid arthritis. They performed the study to determine whether neuropathy and degenerative vascular disease are characteristic of these abnormalities. Observations of both vibratory sense and oscillometric indices were made at various points on both upper and lower extremities. Standard methods were employed on 94 normals, on 24 patients with gout and 75 arthritics. The oscillometric index was essentially normal in both gouty and arthritic patients. Viewed statistically, patients of both categories were found to have elevated thresholds for the vibratory sense. A positive correlation was observed between the duration of disease and the elevation of vibratory threshold for patients with rheumatoid arthritis.

◇ Respiratory and Cardiac Deaths in Los Angeles Smogs During 1956, 1957, and 1958. C. A. Mills. pp. 307-315.

Earlier studies by the author on the relation between respiratory and cardiac deaths in the Los Angeles area had been criticized from several points of view. In the current article, the author has attempted to strengthen his case by: (1) basing his study on actual smog analysis, (2) relating death rates in the study area to rates for the country as a whole and (3) changing the method of adjusting the data to eliminate seasonal trends.

Significant correlation was observed between daily oxidant maxima and daily temperature maxima. A clear relationship was also established between oxidant maxima and excess cardiac and respiratory deaths. In the area of interpretation of the results, the author considers that high daily temperatures *per se* did not affect the death rate up to temperatures of 95° F. Accordingly he did not use data for days on which the temperature rose to 96° or more. The author does not demonstrate the validity of this treatment of the effect of temperature. The author concludes that there are at present about 400 smog-correlated deaths per year in Los Angeles county. On the basis of the analysis of the data he concludes that the maximum allowable concentrations of total oxidant (as determined by the potassium iodide method) should not exceed 0.1 ppm. To attain this level as a daily maximum it would be necessary to reduce the present unburned hydrocarbon concentration by 85 or 90 per cent.

◇ The Treatment of Respiratory Acidosis with THAM. G. L. Brickman; D. G. Remp; E. O. Coates, Jr., and E. M. Priest. pp. 341-346.

THAM (Trishydroxy methylamino-methane), a weak organic base, 80 per cent dissociated at pH 7.4, had been used successfully in treating artificial respiratory acidosis in experimental animals. The work reported in this paper was undertaken to investigate the possibility of using THAM to treat respiratory acidosis in man. It was used on four male subjects of ages 48 to 61 years in two hour observations. Before, during and after administration of the drug, expired air, arterial blood and urine samples were collected to measure blood pCO<sub>2</sub>, pO<sub>2</sub>, pH, minute ventilation and urine pH and bicarbonate concentrations. After a control period, 20 gm. of THAM in glucose solutions were infused intravenously over a 40 minute period. The data presented show that minute ventilation, arterial pO<sub>2</sub> and pCO<sub>2</sub> were decreased during the infusion. The pH of arterial blood meanwhile increased from an average control level of 7.37 to about 7.43 during infusion. Thirty minutes after termination of drug administration the pH of arterial blood was still elevated significantly above the control level. The urine picture showed consistent elevation of both pH and bicarbonate levels.

The authors conclude that the drug THAM is well tolerated in the levels employed. They report the use of the drug by oral route on two severe cases of acute respiratory acidosis with temporary relief of the symptoms. Concomittant tetany was controlled with calcium gluconate.

Motor exhaust gases and lung cancer in Cincinnati. Mills, C. A. p. 316.





**AMERICAN JOURNAL OF PHYSIOLOGY. Vol. 198, Feb. 1960.**

◇ **Renal Function in Hypertensive Cardiovascular Disease of Rat.** F. N. White; M. P. Sambhi, and A. Grollman. pp. 221-222.

Weanling rats were rendered hypertensive by feeding them for several weeks on potassium-free or choline-free diets. The degree of hypertension produced is reflected in the systolic blood pressure of around 155 mm. Hg as compared with 114 mm. Hg for the normotensive group. Urea clearance, inulin clearance, PAH clearance and  $T_m$ , and protein excretion were measured. Morphological changes in heart, blood vessels and kidneys were demonstrable in the adult rats similar to those associated with essential hypertension in man. Among the aspects of function tested, excretory function (urea clearance), tubular function ( $T_m$  for PAH) and renal blood flow (PAH clearance) were unaltered by the experimental hypertension. The only changes that were significant were the glomerular filtration rate (inulin clearance) and a slight proteinuria. The authors interpret these results as indicating that renal changes were secondary to or incidental to this experimental hypertension and not the causative agent.

◇ **Cardiovascular Functions in the Dog Rewarmed Rapidly and Slowly From Deep Hypothermia.** H. E. D'Amato; S. Kronheim, and B. G. Covino. pp. 333-335.

Previous reports of cardiovascular function during and after rewarming from hypothermia were conflicting. The present study was undertaken to evaluate in a single study these functions during slow and rapid rewarming in animals not subjected to surgery as part of the procedure. A total of 25 mongrel dogs of both sexes, 7 to 16 kg. body weight were used. Five groups were studied. Two groups of 5 dogs each were cooled to a rectal temperature of 25 C. Group I was rewarmed rapidly (87 minutes average). Group II was rewarmed slowly (270 minutes). Of 15 dogs cooled to a rectal temperature of 20 C., five in Group III were rewarmed rapidly (95 minutes) and 10 (Groups IV and V) were rewarmed slowly. The five dogs comprising Group V were infused with 500 ml. of warm saline (35 C.) at a rate of 100 ml./min. The parameters studied were mean arterial pressure; heart rate; cardiac output, and work output of the heart. The saline infusions were carried out in an attempt to ascertain whether the cardiovascular failure was cardiac or peripheral in origin.

The results clearly showed that cardiovascular function is maintained better with fast than with slow rewarming. Statistically significant reductions in the parameters were observed for dogs rewarmed slowly. Slow rewarming accompanied by saline infusion resulted in improved maintenance of function. The authors interpreted this as indicating that the failure observed during slow rewarming was peripheral rather than cardiac in origin. No significant differences were observed to result from the initial level of hypothermia.

**Prolonged response of skeletal muscle in the absence of penetrating anions.** Falk, G., and J. F. Landa. p. 289.

**Respiratory centers in the albino rat.** Ondina, D. M.; W. S. Yamamoto, and W. S. Masland. p. 389.

**Patterns of response of the paravertebral musculature to visceral stimuli.** Eble, J. N. p. 429.

**THE AMERICAN JOURNAL OF ROENTGENOLOGY. Vol. 83, May 1960.**

◇ **Prolonged Cathartic Abuse Resulting in Roentgen Evidence Suggestive of Enterocolitis.** G. E. Plum; H. M. Weber, and W. G. Sauer. pp. 919-925.

A brief, illuminating statement about chronic constipation opens the discussion. The commonly encountered failure of proprietary cathartic preparations to relieve the condition is noted with the frequently observed sequel of chronic cathartic abuse. This produces changes in the motor activity of the bowel that are of such a nature that an abnormal roentgenographic appearance of the colon and terminal ileum may result.

Barium enema examinations on 27 patients who gave clinical histories of long and excessive use of irritant cathartics revealed loss of colonic haustrations, smooth mucous membrane pattern, often but only apparent shortening of the right side of the colon, shifting constriction of segments and often marked distensibility of the colon. Such changes may be seen in the right colon and terminal ileum or involve the entire colon. Findings of this sort may simulate those of chronic ulcerative colitis for which they have frequently been mistaken. In one case repeat examination 11 months after the patient had stopped taking irritant cathartics no change was noted in the appearance of the colon.

◇ The Induction of a Disordered Motor Function Pattern in the Small Bowel by the Administration of Mineral Oil. M. H. Poppel, and C. K. Bangappa. pp. 926-927.

The authors noted disordered motor function pattern (excessive small bowel segmentation) in various patients, in whom no other etiology could be found except the presence of chronic constipation and the prolonged use of mineral oil. In order to elucidate this matter, 100 subjects without gastrointestinal symptoms were given 40 cc. of mineral oil for 10 to 12 days. Preliminary gastrointestinal series were normal.

Repeat gastrointestinal series after mineral oil medication on this group showed an incidence of 30 per cent of disordered motor function. The mechanism was admittedly not clear. However the disturbances of small bowel pattern observed in habitual users of mineral oil were shown to be capable of being induced in normal individuals by the administration of this substance.



**ARTHRITIS & RHEUMATISM. Vol. III, Feb. 1960.**

◇ Muscle Atrophy in Rheumatoid Arthritis: An Electrodiagnostic Study. L. D. Amick. pp. 54-63.

Electrodiagnostic studies were performed on 25 rheumatoid arthritics with severe periarticular muscle wasting, a frequent clinical finding lacking satisfactory explanation. Included in the study as a control were 14 normal individuals.

Threshold intensities for stimulation of the ulnar nerve at the elbow and wrist and conduction times in the nerve were within normal limits. Also normal intensity duration (I/T) curves were obtained from the abductor digiti minimi and first dorsal interosseus.

Motor unit action potentials were normal in total duration, duration of negative spike, and amplitude on electromyography. There was no spontaneous activity in the muscles tested.

There was no evidence of dysfunction of the lower motor neuron or muscle fiber in these sensitive clinical tests. The periarticular muscle atrophy in rheumatoid arthritis patients was equated with disuse atrophy, which is known to give normal electrodiagnostic findings.

◇ Spondylitis in Chronic Ulcerative Colitis. N. J. Zvaifler, and W. Martel. pp. 76-87.

X-rays of 100 cases of chronic non-specific ulcerative colitis were reviewed for evidence of ankylosing spondylitis. Suspect cases were recalled for further evaluation by physical examination, laboratory and X-ray studies. Six cases of spondylitis were thus identified. Radiologic findings in this group were identical with those of ankylosing spondylitis. There were no differences in the clinical course of colitis in those with or without spondylitis. The etiologic factors responsible for the concurrent existence of these two disease processes are unknown.

Anti-cytoplasmic factors in the sera of patients with systemic lupus erythematosus and certain other diseases. Deicher, H. R. G.; H. R. Holman, and H. G. Kunkel. p. 1.

The precipitin reaction between rheumatoid factors and gamma globulin: Studies by double diffusion in agar. Franklin, E. C. p. 16.

"Rheumatoid" serologic reactions in experimental animals. II. Bentonite flocculation test in rats with experimental arthritis. Lerner, E. M., II; K. J. Bloch, and R. R. Williams, Jr. p. 26.

Hemagglutination study of serum factors related to L. E. cell formation. Lee, R. C., and W. V. Epstein. p. 41.

A study of some "acute phase reactants" in rheumatic disease. Decker, B.; W. F. McGuckin; B. F. McKenzie, and C. H. Slocumb. p. 49.

The incidence of leukemia and related diseases in patients with rheumatoid (ankylosing) spondylitis treated with x-ray therapy. Silberberg, D. H.; L. A. Frohman, and I. F. Duff. p. 64.



**ARTHRITIS & RHEUMATISM. Vol. III, April 1960.**

◇ **Dexamethasone: Antirheumatic Properties, Hormonal Effects and Adverse Reactions.** R. L. Black; W. E. Reefer; J. R. David; K. J. Bloch; G. E. Ehrlich, and J. J. Bunim. pp. 112-128.

Dexamethasone, the most potent anti-inflammatory corticosteroid thus far produced, was administered clinically for eight to 16 months to 27 patients with rheumatoid arthritis. Clinical, hormonal, metabolic, and adverse effects of the drug were evaluated during this therapeutic trial.

Of the 27 patients treated (0.5-4.0 mg. daily) 20 had a satisfactory antirheumatic response as evidenced by improved functional status. An additional five patients were rendered more comfortable, but failed to improve in functional status. Combined with salicylate therapy, dosage reductions of dexamethasone were accomplished in 77 per cent of the patients treated.

Hormonal effects of dexamethasone included suppression of ACTH and decreased thyroid function. The latter may or may not be related to suppression of TSH (thyroid-stimulating hormone). Thyroid function measured by radioactive iodine uptake was reduced in 11 of 19 patients and was reversed by administration of exogenous TSH. Abnormal glucose utilization rates were present in 11 of 22 cases indicating impaired carbohydrate metabolism.

The most common side effect of the group was a definite weight gain in 19 patients. Other ill effects included three pathologic fractures and one peptic ulcer. There were no psychoses. Two patients expired during the study; one was a result of thrombophlebitis and cause of death in the second was undetermined.

◇ **The Physiologic Effects of Dexamethasone.** K. M. West; P. C. Johnson; A. A. Kyriakopoulos; W. J. Bahr, and C. E. Bloedow. pp. 129-139.

Hyperglycemic and eosinopenic properties, adrenal suppression and urinary water and electrolyte excretions were determined after treatment with dexamethasone in man, and then compared with reported anti-inflammatory potency of this corticosteroid. Hyperglycemic and eosinopenic potencies of dexamethasone were similar to its anti-inflammatory activity (25-30 times hydrocortisone and 5-8 times prednisolone). Test results also suggested that the adrenal suppression activity was roughly equal to anti-inflammatory potency of dexamethasone. Determinations revealed a slight antidiuresis of water, sodium, and chloride after treatment with this steroid. A potassium diuresis was also noted, but urinary excretion of magnesium remained unchanged.

**Special report therapeutic evaluation in rheumatoid arthritis.** Calkins, E.; R. L. Black; G. M. Clark; J. L. Hollander; D. Mainland; W. M. Mikkelsen; C. Ragan, and C. L. Short. p. 101.

**The microscopic structure of human synovial tissue.** Castor, C. W. p. 140.

**The absorption of serum albumin and gamma globulin from the knee joint of man and rabbit.** Rodnan, G. P., and M. J. MacLachlan. p. 152.

**Examination of the latex fixation test using sulfated mucopolysaccharides.** Heimer, R., and R. H. Freyberg. p. 158.

**Recurrent attacks in Reiter's disease.** Csonka, G. W. p. 164.

**Carcinoma of the breast metastatic to the bones of the foot: A case report.** Jacox, R. F., and T. M. Tristan. p. 170.

**BRAIN. Vol. 83, 1960.**

◇ **The Intramuscular Nerve Endings in Myasthenia Gravis.** E. R. Bickerstaff, and A. L. Woolf. pp. 10-23.

Using recently described technics for better localization of the terminal innervation zone in muscle biopsies and vital staining with methylene blue along with histochemical demonstration of cholinesterase, the authors studied muscle biopsies from seven patients with myasthenia gravis. The cases were divided into two groups, those in which biopsy specimens taken from muscles only slightly affected clinically showed no inflammatory or degenerative changes in non-neural elements, and a second group showing compact aggregations of leucocytes, predominantly lymphocytes, increased variation in size of muscle fibers, and in some cases degenerative changes in other muscle fibers. The predominant findings in the first group consisted of increase in the length of the synaptic area by elongation of the endplates and by

formation of double or quadruple endplates. In the second group these findings were present but were more or less obscured by disorganization of the terminal innervation similar to that seen in myositis or myopathic muscles, namely proliferation of the distal 200-300 micra of the subterminal fibers with delicate sprouts and terminal expansions.

◇ **The Changes in the Motor End-plate in Myasthenia Gravis.** V. MacDermot. pp. 24-35.

The author presents findings in eight cases of myasthenia gravis on whom muscle biopsy was performed. Routine staining technics showed definite changes in one case, minor changes in two cases, and no abnormalities in five cases. Intravital stains with methylene blue showed abnormalities in all cases. All patients showed instances of swelling and irregularity of the axons and myelin sheaths after the emergence of the distal nerve fibers from the intramuscular nerve bundles. In addition, most showed abnormal tortuosity of these fibers. Fine beaded nonmyelinated fibers, usually accompanying the myelinated fibers, were also seen. Abnormal branching with complex terminal arrangements and abnormally long branches were present in all cases. There was considerable variation in size and shape of the end-plates, elongated in all cases, with ultraterminal fibers arising as prolongation of certain telodendria. These findings appear to agree with and extend the observations of Coers, Woolf, Bickerstaff and others on the histologic changes in myasthenia gravis.

**Spontaneous cerebellar haemorrhage. A study of 34 consecutive cases treated surgically.** McKissock, W.; A. Richardson, and L. Walsh. p. 1.

**Variations in the responses evoked by light along the specific pathways.** Naquet, R.; H. Regis; M. Fischer-Williams, and A. Fernandez-Guardiola. p. 52.

**Electrical activity of the cerebral cortex of the unanaesthetized cat during attentive behavior.** Horn, G. p. 57.

**The effect of auditory and visual stimulation on the skin potential response of schizophrenics.** Venables, P. H. p. 77.

**The somatic sense of space (choreaesthesia) and its threshold.** Renfrew, S., and I. D. Melville. p. 93.

**The relative values of the marchi method and some silver impregnation techniques.** Bowsher, D.; Alf Brodal, and F. Walberg. p. 150.

**Central cortical projections to motor and somato-sensory cell groups.** Kuypers, H. G. J. M. p. 161.



**BRITISH MEDICAL JOURNAL. No. 5178, April 2, 1960.**

◇ **Acute Ischemia in Limb Injuries.** E. G. Hardy, and D. J. Tibbs. pp. 1001-1005.

Pathologic studies suggest that acute complete limb ischemia has a very short time limit beyond which return of circulation is useless and may even be dangerous.

The authors analyze what they think are the main causes of failure in restoring adequate circulation in acute traumatic limb ischemia. Some of these causes are unavoidable because of associated soft tissue trauma, but the majority are attributable to undue delay in reopening an occluded main artery. The circulation must be reestablished in the first few hours after injury. Precious time is often lost either because of fear of doing harm by exploration or the hope that improvement may follow conservative treatment. The hope of improvement rests mainly on the misconception that arterial spasm is a frequent cause of traumatic ischemia. The authors feel that the role of arterial spasm has been over-emphasized. An intrinsic or extrinsic mechanical blockage is almost invariably present, and the artery distally to this is contracted from loss of the vis a tergo. A suggested scheme of management is outlined.

◇ **Incidence of Chronic Arm Edema after Treatment of Breast Cancer.** A. H. W. Nias. pp. 1005-1008.

Arm swelling is a common symptom after treatment for breast cancer. The authors examined a group of 305 patients. Since the object of the survey was to study morbidity due to treatment rather than disease, patients with swelling due to cancerous invasion of the axilla were excluded. Only a difference in circumference of the arms of more than 2.5 cm., measured at levels 10 cm. above and below the tip of the olecranon process, has been regarded as significant.

Of the 305 patients measured, 109 (36%) were found to have 2.5 cm. or more difference between their arms. Of the involved patients there were 58 with 2.5 to 5 cm. of swelling and 51 with more than 5 cm. of swelling.

The arm swelling was attributed to the following factors: postoperative x-ray treatment to the axilla; cancerous involvement of the axillary lymph nodes removed at radical mastectomy, and radical mastectomy itself.

This shows that, with the present orthodox method of treating breast cancer, one-third of the patients may expect a significant amount of arm swelling afterwards.



### GERIATRICS. Vol. 15, May 1960.

◇ Tidal Drainage in Bladder Rehabilitation. P. D. O'Loughlin, and P. A. Dudenhoefer. pp. 349-354.

The purpose of tidal drainage of the bladder is to condition a bladder-emptying reflex, keep infection at a minimum, maintain or increase bladder capacity and to flush out small bladder stones. The principal contraindication to tidal drainage is severe hydronephrosis with ureteral reflux.

Case reports on the use of tidal drainage in two quadraparetics and one cerebral thrombosis patient indicate the major benefits derived by these patients are increased bladder capacity and rapid clearing of cystitis. Only the cerebral thrombosis patient remained catheter free after a tidal drainage program.

The greatest single benefit of tidal drainage is the rapid control of infection and prevention of accumulation of debris. Tidal drainage has a place in the treatment of long term chronic disability, and deserves a trial of use when other methods of bladder care have failed.

◇ Public Assistance Role in Geriatric Rehabilitation. D. C. Larson. pp. 404-406.

A pilot study of rehabilitation efforts in a geriatric setting was made within a public assistance agency with the cooperation of the medical profession. The goal of the program was to return patients to community living.

Results achieved during the first two years of the program included immeasurable gains in human values to the patients. There were measurable decreased financial expenditures for rehabilitation efforts as compared with long term convalescent care of patients leading to ultimate reduction in the costs of public assistance for the aged.

Residents of homes for the aged. Goldmann, F. p. 329.



### THE JOURNAL OF BONE AND JOINT SURGERY. Vol. 42-A, April 1960.

◇ Spondylosis of the Cervical Spine with Compression of the Spinal Cord and Nerve Roots. P. Teng. pp. 392-406.

Laminectomies were performed on 20 patients with spondylosis causing progressive symptomatology for one to 12 years. Pain in the shoulder girdle and upper extremities was a common complaint and varied from a dull ache to sharp radiating pain. Dyesthesias, paresthesias, unilateral cranial pain, and thoracic pain were also present in some patients. A variety of neurological deficits were present. In 14 patients, hyperextension of the neck produced partial or complete block during manometry.

Arachnoid adhesions and dilatation of cord vessels were found in most patients, swollen nerve roots in nearly half the patients and atrophic nerve roots in three of the patients. Definitive surgical procedures included foraminotomy in 15 patients, excision of arachnoid adhesions in 14 patients, resection of the denticulate ligaments in 19 patients, and removal of an osteophytic ridge in one patient.

The author's followup of 15 patients indicated complete relief of pain in eight patients, improvement in motor function of the lower extremities in 12 patients, and satisfactory functional improvement in the hands and arms of seven patients.

The author concluded that the following factors contributed to the production of symptoms and signs of spinal cord involvement: 1) posterior or posterolateral displacement of the spinal cord by osteophytic ridges; 2) "varicosity" of the spinal cord as the result of partial or complete obstruction of the spinal canal; 3) anchoring of the cord by denticulate ligaments; 4) focal arachnoiditis; 5) posterior compression of the cord by a thickened laminal arch, and 6) posterior pressure caused by bulging or corrugation of the yellow ligaments at the level of an osteophytic ridge, particularly when the neck is hyperextended.



◇ **Fractures in Amputees.** R. A. Pyka, and P. R. Lipscomb. pp. 499-509.

The authors reviewed the records of the Mayo Clinic from 1910 through 1958 and found 15 patients with fractures in amputated extremities.

Fractures in upper extremity amputees occurred in three patients and were not related to their amputations. Eleven lower extremity amputees fractured their amputated limb with seven patients having below-knee and four above-knee amputations.

Healing of fractures in amputees did not differ materially from healing in persons who have not had amputations except with fractures of the upper end of the femur in above-knee stumps. In these patients bone healing occurred faster and better as the result of shortened leverage of the distal fragment. No ill effects were observed from the temporary use of skeletal traction or from internal fixation of femoral neck fractures with Smith-Petersen nails.

In fractures of the femoral neck, bone union and good position should be insured when possible because the patient will probably have better control of his prosthesis with less discomfort than would be the case with a fibrous union.

A study of experimental trauma and attempt to stimulate growth of the lower femoral epiphysis in rabbits — III. Ford, L. T., and G. M. Canales. p. 439.

A new bone affection: Feathering. Frost, H. M. p. 447.

Flexor pollicis longus muscle. Its morphology and clinical significance. Mangini, U. p. 467.

A brace attachment to permit knee mobilization in hip spicas. Rhineland, F. W. p. 510.



**THE JOURNAL OF CLINICAL INVESTIGATION. Vol. 39, Mar. 1960.**

◇ **Suppression of Uric Acid Synthesis in the Gouty Human by the Use of 6-Diazo-5-oxo-1-norleucine.** Arthur I. Grayzel; J. E. Seegmiller, and Ethel Love. pp. 447-454.

A more rational therapy of patients with gout who overproduce uric acid would seem the inhibition of uric acid overproduction by pharmacologic agents. This approach has been experimented by the authors with the compound DON (6-diazo-5-oxo-1-norleucine) which is known to interfere with purine biosynthesis.

The product does show a suppressive influence on the metabolic process of purine and on serum urate levels of gouty humans. The incidence of toxic effects however, even at relatively low doses, is too high to prevent the practical use of this particular drug.

Bilateral studies of cerebral oxygen uptake in young and aged normal subjects and in patients with organic dementia. Lassen, N. A.; I. Feinberg, and M. H. Lane. p. 491.



**THE JOURNAL OF CLINICAL INVESTIGATION. Vol. 39, April 1960.**

◇ **Physiological Factors Affecting Airway Resistance in Normal Subjects and in Patients with Obstructive Respiratory Disease.** John Butler; Colin G. Caro; Raphael Alcalá, and Arthur B. DuBois. pp. 584-591.

Airway conductance (the reciprocal of airway resistance) depends upon the patency, number and length of the conducting airways. The effects on airway conductance of chest strapping, bronchodilator drugs, exercise, forced breathing, oxygen, carbon dioxide, and old age were measured in normal subjects and compared with similar observation in patients with asthma, bronchitis and emphysema.

Airway conductance was similar in young and elderly people and remained relatively constant over several hours. In old age there was a reduction in the maximum flow rate, probably due to a reduction in the maximum pressure generated by the respiratory muscle and to an increased lung tissue resistance. In patients with asthma, emphysema and chronic bronchitis the airway resistance was elevated in most. The conductance was found to vary directly with lung elastic pressures rather than with lung volume. At the same lung volume there was a rise in airway conductance when the lung elastic pressure was increased following chest constriction. This is presumably due to an enlargement of the airways as a result of the greater pull on their walls. The dependence of airway conductance upon lung elasticity was altered by bronchodilators.



In normal subjects and in patients the use of these drugs increased airway conductance in the absence of any alteration in lung elastic pressure. This suggested that bronchodilators by their action in reducing tonic effects in the airway walls, allowed a greater distention of the airway from the mechanical effects of the existing lung elastic pressure.

Forced breaths, breathing oxygen and different concentrations of carbon dioxide did not alter the airway resistance. After exercise there was only a slight reduction in the airway resistance in normals. In several patients with mild asthma airway resistance increased after forced breathing or exercise. The mechanism of this response is unknown, but it is presumably dependent upon changes in the airway wall, the lung elastic pressure at different volumes being unchanged or increased.

**Some effects of restriction of chest cage expansion on pulmonary function in man: an experimental study.** *Caro, Colin G.; John Butler, and Arthur B. DuBois. p. 573.*



## JOURNAL OF NEUROSURGERY. Vol. XVII, Jan. 1960.

### ◇ The Neurosurgeon's New Interest in the Pituitary. B. S. Ray. pp. 1-21.

Three hundred and sixty-five hypophysectomies were performed on patients with advanced cancer in the seven years between March 1952-1959 at the New York Hospital, the large majority for breast, 16 for prostate and 21 for various other types. The operation has not proved beneficial for cancer except in the breast, the prostate and possibly the thyroid. In breast cancer rationale for ablation of the pituitary is provided for by the fact that roughly half the cases of breast tumor show a degree of "dependence" on the presence of estrogen in the body, which can be abolished by castration and adrenalectomy. The same effect is accomplished by hypophysectomy, since the two glands are dependent for their function on trophic secretions by the pituitary. Two other factors possibly influencing breast cancer are growth hormone and mammatrophic hormone (prolactin). Out of 109 cases followed more than 28 months, there were 7.3 per cent operative deaths, 49.5 per cent remissions and 43.1 per cent failures. It is considered the equal or superior to all other forms of endocrine therapy and glandular ablation in the prescribed treatment of metastatic breast cancer. Eleven patients with advanced diabetes mellitus and proliferative retinopathy with failing vision were subjected to hypophysectomy and seven were benefited. In one or two cases even, there were signs of improvement in the retinopathy and not just cessation of progression which may suggest that growth hormone may be a factor in the development of atherosclerosis. Other uses for hypophysectomy are malignant exophthalmos and certain cases of Cushing's syndrome and acromegaly.

### ◇ Selective Sacral Neurotomy for Hunner's Ulcer. T. H. Mason; G. L. Haines, and B. W. Leversee. pp. 22-26.

Chronic interstitial cystitis with ulcers in the summit of the bladder was described by G. L. Hunner in 1915.

The authors describe a method of sectioning the anterior division of the third sacral nerve bilaterally from behind through the foramina of the sacrum and for added assurance, electric stimulation prior to section of each anterior nerve with a current of 60 cycles for 60 seconds and recording the maximum detrusor actions by cystometric recording of from 15 to 30 cms. of water. The large anterior division of the third sacral nerve is ligated. Gradually diminishing bladder capacity is an accompaniment of Hunner's Ulcer as it is in spastic paraplegia and this is relieved along with the ulcer and its painful symptoms by this operation.

Heimburger and Freeman writing in the Journal of Neurosurgery in 1947 and 1948 are quoted as demonstrating by procaine injections that the anterior division of the 3rd sacral nerve rendered the dominant innervation to the human bladder.

Meirowsky, Patton, Schwartz, et al, were quoted as including the sacral nerves in their rhizotomies for spastic paraplegia and converting spastic and neurogenic bladder to "automatic" (autonomous) bladder in most cases.

### Acute extradural hematomas without demonstrable skull fractures. Mealey, J., Jr. p. 27.

**Clinical evaluation of procaine and hypertonic glucose as possible adjuncts to carotid arteriography.** *Tindall, G. T., and J. R. Jackson. p. 43.*



**JOURNAL OF NEUROSURGERY. Vol. XVII, Mar. 1960.****◇ The Treatment of Experimental Lesions of the Spinal Cord of Dogs with Trypsin. L. W. Freeman and D. E. Bowman. pp. 259-265.**

The central thesis of this article is that spinal cord injuries of not too drastic a nature but unequivocally interrupted in type might recover but for the interposition of rapidly growing connective-tissue scar at the site of the lesion.

Forty-eight dogs were retained for this study. The animals were subjected to a Brown-Séquard type surgical lesion in a relatively avascular part of the left mid-dorsal spinal cord. Six of the dogs received nothing or inactive material. The remaining dogs were treated intrathecally by the use of plastic tubes with unmodified trypsin or with trypsin modified by hypo-chlorite or were treated by modified trypsin intramuscularly rather than intrathecally. The expectation was that the enzyme, being a fibrinolytic agent would allow a fibrin network bridge to form for the regeneration of the axons but at the same time would prevent the formation of a formidable connective-tissue barrier. Evaluation was carried out by traditional neurologic testing, stimulation and recording studies and by study of the gross and histologic specimens after sacrifice of the animals. The results agreed rather well. Five of six of the control dogs did not do well. In contrast 30 of the 42 treated animals showed functional ability beyond that expected in a Brown-Séquard animal, 21 of the animals achieving an excellent functional status.

**◇ Intracranial Aneurysms: Results of Surgical Treatment. J. L. Poppen and C. A. Fager. pp. 283-296.**

A series of 277 patients with verified intracranial aneurysms were presented. The follow-up periods ranged from 1 to 20 years. Fifty-one patients were not submitted to any form of surgical treatment and 21 of these died as a result of initial or repeated hemorrhage; seven further patients died of recurrent hemorrhage from three months to six years later which compares with the approximately 45 per cent early mortality and 10 to 15 per cent subsequent mortality in the literature of non-surgically treated cases.

Carotid ligation alone was used in 101 patients. In these there were 96 immediate recoveries including 11 with neurologic defect, five immediate deaths and 17 subsequent deaths. The trapping procedure was used (ligation of carotid artery with clipping distal to the aneurysm three to four days later) in 26 patients. In these 23 made recoveries immediately, three died nearly immediately and 19 survived 1 to 13 years. Craniotomy or direct intracranial procedure was used in 95 patients mainly for the middle cerebral or anterior cerebral-anterior communicating group of aneurysms. In these there were 60 immediate recoveries without neurologic defect, 11 patients with pre- or post-surgical defect; 17 deaths following craniotomy, six subsequent deaths and one recurrent non-fatal hemorrhage. The surgical mortality averaged 8 per cent. The surgical morbidity averaged 5.7 per cent. The authors question whether surgical intervention will ever reduce the 30 per cent initial mortality resulting from a devastating first hemorrhage. They feel these observations lend support to the opinion that surgical treatment may effectively reduce the mortality rate and the risk of recurrent hemorrhage in patients with intracranial aneurysms.

Intracarotid injection of sodium amytal for the lateralization of cerebral speech dominance: experimental and clinical observations. Wada, J., and T. Rasmussen. p. 266.

**JOURNAL OF PEDIATRICS. Vol. 56, April 1960.****◇ Birth Injuries of the Spinal Cord. Harvey R. Leventhal. p. 447.**

The author presents six case histories of children who had birth injuries of the spinal cord, most of which were not recognized until some weeks or months later. The injuries are said usually to occur at the cervicothoracic junction, with anesthesia below T<sub>1</sub> or T<sub>2</sub>. One of these children had a low thoracic lesion, one who had shown a negative iodine-starch test for sweating later showed a normal test. The spine X-rays were read as normal, showing neither fracture nor dislocation. Myelograms may be helpful, but there is not a complete block at the level of the lesion. He points out that the diagnosis must be made on the basis of history and physical findings. Important signs are a weak cry, soft bulging abdomen, absent voluntary motion of legs, loss of sweating and subsequent poor temperature control, and presence of reflex activity but failure to cry in response to stimulation of lower extremities. It is important to point out that four of these six children are still alive several years after the onset of paralysis, two having died of pneumonia.

**◇ Observations on Rheumatic Nodules Over a 3-Year Period. Janet S. Baldwin; Josephine M. Kerr; Ann G. Kuttner, and Eugenia F. Doyle. pp. 465-470.**

Every patient admitted between 1928 and 1958 to the Children's Medical Service of Bellevue Hospital with rheumatic fever who showed nodules was included in the study. Careful records

and follow-up examination show a decrease in mortality and in severity of the disease during this period of time. Between 1928-1942 the mortality rate was 16.4 per cent. Between 1943-1958 the mortality rate was 4.3 per cent. However, the percentage of attacks associated with rheumatic nodules shows no significant difference between these two periods (11.3 per cent versus 9.4 per cent). The nodules occurred only in patients with active carditis but rarely occurred early in the course of an attack, being associated rather with prolonged periods of rheumatic activity. The presence of a single "crop" of a few nodules appears to have the same significance as the presence of many, but recurrent "crops" of nodules were associated with a much higher mortality rate (58 per cent).

**Ristocetin, a laboratory and clinical evaluation in children.** *Dries, C. P., and Richard Koch.* p. 498.

**Psittacosis: exposure to infected turkeys.** *Blattner, R. J.* p. 562.



### THE JOURNAL OF PEDIATRICS. Vol. 56, May 1960.

**The adaptive changes in the immediate postnatal period, with particular reference to respiration.** *Karlbirt, Peter.* p. 585.

**Ventilation and ventilatory mechanics in the newborn.** *Swyer, Paul R.; R. C. Reiman, and John J. Wright.* p. 612.

**A familial convulsive disorder with an unusual onset during intrauterine life.** *Badr El-Din, M.K.* p. 655.

**The mechanism of tick paralysis.** *Blattner, Russell J.* p. 698.



### JOURNAL OF PHYSIOLOGY. Vol. 150, Jan. 1960.

◇ **Physiological and Structural Changes at the Amphibian Myoneural Junction in the Course of Nerve Degeneration.** *R. Berks; D. Katz, and R. Miledi.* pp. 145-168.

The changes occurring at the myoneural junction of the frog after motor nerve section were investigated by intracellular recording of end plate potentials and by electronmicroscopy. At 20 C. junctional transmission in the frog's sartorius failed at five days and by this time end plate potentials ceased. Associated with these electrical changes were gross structural changes of the motor nerve terminals. Mitochondria disintegrated and large structures consisting of apparently agglutinated vesicles formed. About one week after spontaneous discharge of the end plate potentials ceased, a local spontaneous activity at a much lower rate gradually resumed at the degenerated end plate. This discharge was maintained for many weeks. The cessation and subsequent resumption of end plate activity was not related to any change in chemical sensitivity. It is suggested that the Schwann cell that has replaced the motor nerve ending at the synaptic position is responsible for the renewed small scale electrical activity through release of packets of acetylcholine.

◇ **Electrical Activity of Mammalian Intrafusal Fibers.** *C. Eyzaguirre.* pp. 169-185.

The tenuissimus muscle of the cat along with its nerve and part of the sciatic nerve were isolated. The activity of the intrafusal muscle fibers potentials were recorded from the muscle surface, while the motor fibers to the spindle were stimulated. A sequence similar to that of propagated potentials within a volume conductor was recorded. The appearance of propagated potentials at the intrafusal muscle fiber indicates that the intrafusal fibers are different than the slow muscle system of the frog which gives rise to junctional nonpropagated potentials. On stimulation of some of the efferent fibers to the spindle, the intrafusal potentials obtained were complex. This complexity is probably due to activity originating from several spindles. Complex potentials were more frequently obtained if more than one spindle motor fiber were stimulated.

Curare blocked intrafusal potentials lending further support to the conclusion that intrafusal potentials are propagated. When a single intrafusal motor nerve fiber was stimulated with two shocks separated in time, the second intrafusal potential completely disappeared when the interval was reduced to 0.7 ms. and for shocks having intervals between 0.7 and 3.4 ms. the second intrafusal potentials was delayed.

**The effects of electrical stimulation of visceral afferent nerve fibers on monosynaptic and polysynaptic reflex responses.** *Evans, M. H., and A. McPherson.* p. 105.

The fine structure of the neuromuscular junction of the frog. Birks, R.; H. E. Huxley, and B. Katz. p. 134.

The motor regulation of mammalian spindle discharge. Eyzaguirre, C. p. 186.



## JOURNAL OF PHYSIOLOGY. Vol. 150, Feb. 1960.

◇ The Role of Non-Myelinated Fibers in Signaling Cooling of the Skin. W. W. Douglas; J. M. Ritchie, and R. W. Straub. pp. 266-283.

Cooling has generally been recognized to be signaled by small myelinated fibers of the A Delta type. This study investigated the response of the non-myelinated C fibers in cutaneous nerves on skin cooling. The cutaneous branch of the cat's saphenous nerve was studied. The C fibers were found to begin discharge when skin temperature was lowered from 34 to 31 C. Most all the C fibers had discharged when skin temperature was lowered by about 11 C. The intensity of the C fiber discharge varied linearly with the logarithm of the fall in skin temperature. Warming the skin produced no discharge in the C fibers. The cold sensitive C fibers were also sensitive to mechanical stimulation such as produced by a cotton swab drawn across the skin. The C fibers took a second or so longer to reach maximal intensity and diminished more slowly than did the Delta fibers. Since the non-myelinated fibers far outnumber all the myelinated fibers, C fibers must play an important role in signaling thermo and mechanical stimulation of the skin.

◇ Differentiation of Fast and Slow Muscles in the Cat Hind Limb. A. J. Buller; J. C. Eccles, and R. M. Eccles. pp. 399-416.

The factors responsible for the differentiation of muscle into the fast and slow types were studied by recording isometric twitch and tetanic responses of hind limb muscles in cats. The animals studied ranged in age from one day after birth to the adult. The results indicated that all muscles are equally slow in the new born animal and that fast muscles attain adult speed by six weeks. The slowest muscles, soleus and crureus, also quicken but to a lesser extent in the first five weeks and thereafter progressively slow in their responses to approach the adult condition in 16 to 20 weeks. The time course for this differentiation of speed was the same for the three time measurements studied: time to summit of twitch; time from summit to half relaxation of twitch, and interval between stimuli at the tetanic frequency building up to half maximum. The differentiation of fast muscles was unaffected by spinal cord transection or by isolation of the lumbosacral spinal cord from all incoming impulses. However, slow muscle differentiation was greatly depressed with complete failure of the late phase of slowing so that in a few weeks the slow muscles became nearly as fast as normal muscles. The results indicate that the differentiation of slow muscles is largely affected by neural influences exerted from the spinal cord.

Electrophysiological evidence of baroreceptors in the pulmonary artery of the dog. Coleridge, J. C. G., and C. Kidd. p. 319.

The effect on a muscle twitch of the back-response of its motor nerve fibers. Brown, M. C., and P. B. C. Matthews. p. 332.

Synaptic action during and after repetitive stimulation. Curtis, D. R., and J. C. Eccles. p. 374.

Interactions between motoneurons and muscles in respect of the characteristic speeds of their responses. Buller, A. J.; J. C. Eccles, and R. M. Eccles. p. 417.



## NEUROLOGY. Vol. 10, April 1960.

◇ Cerebrovascular Disease. E. S. Gurdjian; D. W. Lindner; W. G. Hardy, and J. E. Webster. pp. 372-380.

An analysis of 600 consecutive patients admitted to the wards of the Grace Memorial Hospitals in Detroit with a diagnosis of stroke on admission or cerebrovascular disease at discharge is presented. The review includes an analysis of the onset and course of the disease, the age distribution of the patients, focal manifestations, angiographic findings and the cause and time of death in 108 patients.

The authors recommend that stroke patients receive careful evaluations to obtain exact diagnosis. Examination should routinely include, in addition to the patient's history and the physical examination, x-rays of the skull, EEG, EKG, carotid compression testing, ophthalmo-

dynamometry, lumbar puncture, and angiography. In some patients, air contrast studies may also be indicated.

Diagnostic studies are needed even in those patients who show improvement. A partial occlusion that is amenable to surgery may exist and its correction will prevent further attacks. Angiograms aid in revealing mass lesions and in uncovering occlusive abnormalities of the larger vessels of the neck and thorax. Ophthalmodynamometry and carotid compression have value in the diagnosis of such occlusion. If occlusions are partial, surgery or anticoagulant therapy may be worthwhile. In progressive disease, the diagnostic studies are necessary to differentiate the mass from the vascular lesions. Episodic focal attacks do not necessarily reflect vascular disease but may be caused by mass lesions or inflammatory and degenerative diseases of the brain and also require careful study.

♦ **Motor Unit Territory and Fiber Density in Myopathies.** Fritz Buchthal; Poul Rosenfalk, and Francesco Erminio. pp. 398-408.

The territory of a motor unit and the number of muscle fibers per cross-sectional area were determined by a multilead electrode technic on 28 patients with myopathic disease. In the pseudohypertrophic type of progressive muscular dystrophy, motor unit territory and muscle fiber density was significantly lower than in normal muscle. In the facioscapulohumeral and the limb girdle types of muscular dystrophy, motor unit territory and muscle fiber density was the same as in normal muscle. In myotonic dystrophy the motor unit territory was reduced to the same degree as in the pseudohypertrophic type but fiber density was the same as in normal muscle. The findings in polymyositis were the same as in myotonic dystrophy. These changes in motor unit territory and in muscle fiber density are related by the authors to other electromyographic findings such as the polyphasic potentials, and the amplitude and duration of action potentials. Histological features such as fiber loss, fiber diameter, connective tissue proliferation and peripheral sprouting are also correlated with the results of electromyography.



**NEUROLOGY. Vol. 10, May 1960.**

♦ **Preliminary Observations on Abnormal Catecholamine Metabolism in Basal Ganglia Diseases.** Andre Varbeau. pp. 446-451.

Based on observations on the production of Parkinson-like syndromes by various tranquilizers and ganglion blocking agents and from studies on the distribution of norepinephrine, serotonin and dopamine in the brain, the hypothesis is formulated that a disorder of catecholamine metabolism may be found in basal ganglia diseases. The urines of 40 patients representing Parkinson's disease, Sydenham's chorea, congenital chorea, Huntington's chorea, choreo-athetosis, dystonia musculorum deformans, Wilson's disease and drug-induced Parkinsonism were assayed for the pressor response of Helmer, Sjoerdsma's 5-HIAA determination and the iodine reaction of Simola. The results were positive for the Helmer and Simola reaction but negative for 5-HIAA, and indicate that an abnormality in the metabolism of catecholamine is present in a wide variety of basal ganglia diseases.

**Amino chemical studies on muscle proteins.** Horvath, B.; J. Miquel; I. Klatzo, and J. B. Proctor. p. 457.



**THE NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262, Mar. 10, 1960.**

♦ **"Delayed" Cutaneous Hypersensitivity to Leukocytes in Disseminated Lupus Erythematosus.** E. Friedman; W. Bardawil; J. Merrill, and C. Hanau. pp. 486-491.

A series of patients with disseminated lupus erythematosus and rheumatoid arthritis has been studied to determine the incidence of a positive test to intradermally administered leukocytes.

The clinical material consisted of 79 patients. The diagnosis of the patients with collagen disease were disseminated lupus erythematosus (18 cases), rheumatoid arthritis (seven cases), active rheumatoid fever (two cases) and allergic vasculitis (one case). Additional subjects included 10 patients who had received multiple blood transfusions, two patients with toxemia of pregnancy and 37 others with a wide range of unrelated pathologic conditions.

Each patient was tested intradermally with plasma and autologous and homologous leukocyte suspensions. A test was considered positive only when the ring of erythema and induration reached at least 10.0 mm. in diameter.

Positive reactions were first noted at 18 hours, with a maximal response at 24 hours and fading at 36 to 48 hours.



Sixteen of 20 patients with disseminated lupus erythematosus demonstrated a delayed cutaneous reaction after intradermal injection of autologous leukocytes. There were no positive skin reactions to either plasma or erythrocytes in these patients or in the control group. Of the four with negative reactors, three were on high dosages of steroids. Two of seven patients with rheumatoid arthritis showed positive reactions to leukocytes. Both patients had negative L.E.-cell preparations. With one exception, all the other 52 patients were negative reactors.

It is suggested that an abnormal gamma globulin, probably an antibody, with binding affinity for intranuclear material of autologous, homologous and heterologous tissues may be responsible for this reaction.

◇ **Extrapulmonary Manifestations of Bronchogenic Carcinoma.** J. Knowles and L. Smith, Jr. pp. 505-509.

In this report a classification and brief descriptive summary of some of the extrapulmonary disorders found with carcinoma of the lung have been prepared.

The most frequent metabolic abnormality associated with carcinoma of the lung is the resultant wasting of the host.

Cushing's syndrome has been found in association with bronchogenic tumors of the anaplastic or "oat-cell" type. At post-mortem examination bilateral adrenocortical hyperplasia has been found in all cases. Some patients have exhibited metastatic involvement of the pituitary or adrenal glands.

Hypercalcemia has been seen as a complication of bronchogenic carcinoma. An accompanying hypophosphatemia is frequently found, but serum concentrations of alkaline phosphatase have been normal. Removal of the primary lung tumor in two patients led to a prompt return of serum concentrations of calcium and phosphorus to normal levels.

Indirect evidence for a persistent "inappropriate secretion of antidiuretic hormone" in the presence of bronchogenic carcinoma has been presented in two patients.

The carcinoid syndrome has been described in approximately seven patients. Typical features of the carcinoid syndrome are flushing, prostration, explosive diarrhea, dyspnea with wheezing respiration, hepatomegaly and the presence of a systolic murmur.

Gynecomastia has been considered as an endocrine complication of bronchogenic carcinoma.

Neuromuscular disorders associated with carcinoma of the lung have been recognized for many years. Cortical cerebellar degeneration may occur in a pure form or as part of a mixed syndrome. The symptoms are ataxia, nystagmus, dysarthria, intention tremor or vertigo. Peripheral neuropathy may be purely sensory or may present a mixed sensorimotor spectrum. The clinical picture has included numbness, paresthesias, varying loss of all sensory modalities, sensory ataxia and loss of deep tendon reflexes. In some patients motor neuropathy has been observed in conjunction with the sensory deficit. Mental changes may be quite prominent and may vary from simple impairment of mental acuity to a severe progressive dementia with toxic psychosis.

Muscle weakness, occasionally very marked, may occur. The muscles involved are primarily those of the limb girdles and trunk. Well-documented dermatomyositis may precede by months other clinical evidence of carcinoma of the lung.

The most frequent peripheral sign of bronchogenic carcinoma is hypertrophic osteoarthropathy.

Migratory thrombophlebitis with venous thrombosis may occasionally antedate by months more conventional signs and symptoms of bronchogenic carcinoma. Nonbacterial, thrombotic endocarditis is sometimes associated with bronchogenic carcinoma.

Hemopathic hemolytic and symptomatic hemolytic anemia, fibronolytic purpura and cryofibrinogenemia are hematologic abnormalities found in association with neoplasms of the lung.

None of the mentioned disorders are pathognomonic of bronchogenic carcinoma, but one or more of the syndromes may initiate the symptomatology of a primary lung tumor.

**Pressure-flow characteristics of needles suggested for transtracheal resuscitation.** Bougas, T., and C. Cook. p. 511.



**THE NEW ENGLAND JOURNAL OF MEDICINE.** Vol. 262, Mar. 17, 1960.

◇ **Studies of Pulmonary Function.** B. G. Ferris, Jr. pp. 557-562.

In this presentation the author reviews some of the pulmonary-function tests.

The vital capacity is usually measured by direct-writing spirometers. The residual volume is measured indirectly by gas-dilution technics. The functional residual capacity represent the volume of air in the lungs that mixes with each breath. It can be measured by the nitrogen-washout technic. This method has a number of technical disadvantages. The closed circuit technic involves breathing a mixture of an indicator gas and air or oxygen in a closed system. In general, the closed-circuit technic is convenient, but in severely ill patients it may not truly represent the concentrations in the lungs.

Another method of measuring the thoracic gas volume is to use a body plethysmograph. This method measures all the gas in the thorax, whether contained in well ventilated parts of the lungs or in portions that are poorly ventilated. To differentiate these two volumes, the plethysmographic method may be combined with one of the dilution methods. This is impractical in most patients.

The mechanical properties of the lung has two principal components. One is elastic and is associated with volume changes. It is called the compliance or the volume change per unit of pressure change. The other is resistance or its reciprocal, conductance. The total pulmonary resistance is made up of the resistance of the tracheobronchial tree to the flow of air as well as the viscous resistance of the tissues as they are being deformed.

For both the compliance and the resistance it is necessary to measure the pressure difference between the mouth and the surface of the lungs. The esophagus is used as a site to represent interpleural pressure. Various methods of measuring the mechanical properties of the lungs are mentioned.

The significant changes on lung volume and the mechanical properties of the lungs under various conditions are discussed.

◇ **Mimetic Features of Rheumatic-Fever Recurrences.** A. Feinstein and M. Spagnuolo. pp. 533-539.

The present work analyzes the manifestations of the recurrent attacks of rheumatic fever. One hundred and sixty-one patients who had a total of 370 attacks were studied. Each of the patients fulfilled the modified Jones diagnostic criteria (murmurs of valvular involvement, cardiac enlargement, pericarditis or congestive heart failure).

Sixty-one patients had no valvular involvement with their first attack, and none with subsequent attacks. They have remained free of heart disease. Ninety patients had valvular involvement with their very first attack. Their subsequent attacks brought either no change in the valvular involvement or new valvular involvement, and in some cases there was increased cardiac enlargement, pericarditis or congestive heart failure. In 10 patients no valvular involvement was found at the first attack, but a diastolic murmur was discovered at a subsequent attack. In at least eight of these patients the pattern of discovery suggested that the murmur might have been present without being recognized at the first attack.

Noncardiac manifestations of rheumatic fever were frequently repetitive in all patients, and the features of one attack mimicked those of previous attacks particularly often in patients without valvular involvement.

The results suggest that the rheumatic host has a specific and persistent susceptibility to get or to avoid valvular involvement. If it does not occur with the first attack, it does not occur in subsequent attacks. In most cases in which rheumatic heart disease develops, the valvular involvement is manifested in the very first attack. Subsequent attacks in this group are particularly dangerous because they may lead to further cardiac damage.

In addition to their biologic implications, these data are pertinent to the clinical problem of selecting rheumatic patients for continuous and indefinite antistreptococcal prophylaxis.



**THE NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262, Mar. 24, 1960.**

◇ **Anaphylactoid Reactions to Oral Administration of Penicillin.** J. Batson. pp. 590-594.

Although anaphylactoid reactions to orally administered penicillin are extremely uncommon, they do occur.

In this report two nonfatal cases of anaphylactoid reactions to oral administration of penicillin are presented, and 26 cases, two of which were fatal, are reviewed.

Twenty-five patients gave a history of previous penicillin therapy. Twelve of these 25 patients gave histories suggestive of previous penicillin reactions, seven of which occurred minutes to hours after the drug had been given. A history of other possible allergies was found in 13 patients. The symptoms began within 15 to 30 minutes.

By far the most common symptom was unconsciousness. Gastrointestinal symptoms, skin reactions, facial edema, cyanosis and respiratory distress were noted frequently. The total duration of symptoms varied from 30 minutes to 20 hours. The method of treatment varied greatly; adrenergic agents, antihistamines and oxygen were used most commonly.

◇ **Declining Severity of Rheumatic Fever.** E. Bland. pp. 597-599.

This report concerns the nature and extent of the decline in severity of rheumatic fever in recent years and certain factors that may have been in part responsible.

The initial attacks of rheumatic fever in the past four decades at the House of Good Samaritan in Boston are studied, and the patients are followed in long-term studies.

All patients were in the first two decades of life. There was no significant age difference in the respective groups. The most striking features have been: a modest decline in the incidence of cardiac involvement in terms of residual murmurs, from 75 per cent in 1921-1922 to 60 per cent in 1950-1951; a twofold amelioration in the degree of carditis as indicated by heart size; and an eightfold reduction in mortality rates. A number of factors may have contributed to this favorable change. Perhaps of first importance is the considerable over-all improvement in standards of living. Secondly, the medical profession and the public have been increasingly aware of the causative role of streptococcal infections. Finally the more potent antirheumatic agents of recent years have been of great value.

◇ **Studies of pulmonary function.** Ferris, B. G., Jr. p. 610.



**THE NEW ENGLAND JOURNAL OF MEDICINE.** Vol. 262, Mar. 31, 1960.

◇ **Increased Transmissibility of Staphylococci to Patients Receiving an Anti-microbial Drug.** C. A. Berntsen and W. Dermott. pp. 637-642.

In the present study the question of the transmissibility of staphylococci (i.e. the capacity of a strain to survive transfer to a new host and to maintain itself successfully there) has been investigated in two groups of adult hospital patients. One group received no antimicrobial therapy whereas the other group was treated with tetracycline.

Cultures of the nose and throat were obtained. Strains of staphylococcus aureus were identified and isolated, and the drug susceptibility and bacteriophage susceptibility were determined simultaneously for all isolates from each patient.

A patient was classified as a "consistent" carrier of a particular strain when that strain was isolated on three successive cultures. It was found that the carrier rate in each group on admission was approximately 34 per cent. Antimicrobial therapy during the hospitalization was associated with a 30 per cent increase in carriers of staphylococci, in contrast to the 11 per cent increase that occurred among untreated fellow patients.

Likewise, the exchange of old strains for new strains of staphylococci during hospital residence occurred in 29 per cent more of the prehospital carriers who received tetracycline than among the untreated carriers. In 56 of the 60 treated patients who acquired new strains of staphylococci while in the hospital, the new strains were drug resistant. By contrast, the newly acquired strains of staphylococci were drug resistant in only 10 of the 27 patients who received no antimicrobial therapy.

It is suggested that an important factor in the increased transmissibility of the staphylococci to the treated patients was the drug-induced interference with the usual interspecies relations among the nasopharyngeal flora.

◇ **Evaluation of Familial Biochemically Determined Mental Retardation in Children, with Special Reference to Aminoaciduria.** R. Paine. pp. 658-664.

In this report the presently known genetically determined biochemically based types of mental retardation are reviewed. Best known of the familial metabolic diseases associated with mental retardation are those involving carbohydrate metabolism. Among the lipid diseases, the most important are the progressive leukoencephalopathies and polioencephalopathies, which are suggested clinically by a history of regression, as opposed to slow but uninterrupted forward development from earliest age. The diseases of protein metabolism associated with mental retardation are numerous, although each is in itself rare. Aminoaciduria is the common denominator to most of them. Interpretation of aminoaciduria in such cases is discussed.

The author gives a classification and review of syndromes of mental defects and aminoaciduria according to the patterns of amino acids present in the urine.

Finally a case of apparently sex-linked inheritance of microcephaly, spastic diplegia and convulsions combined with mild generalized aminoaciduria is presented.



**THE NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262, April 7, 1960.**◇ **Acute Renal Failure. S. Franklin and J. Merrill. pp. 711-717.**

This review is an assimilation of a divergent literature on acute renal failure.

Acute renal failure includes such clinical entities as shock kidney, crush syndrome, traumatic uremia, burn nephritis, hemoglobinuric nephrosis and toxic nephrosis. Early diagnosis is essential but may be difficult. Diminished urine volume has not been found a suitable diagnostic criterion. One can have physiologic oliguria with either high or low urine concentrations as a result of variations in water and solute intake. In contrast, acute renal failure has occasionally been associated with minimal oliguria, normal urine volume or even polyuria. Blood urea nitrogen levels may be misleading as an early index of renal function because elevated values are frequently associated with the increased protein catabolic response to various conditions. The composition of the urine may be of value in the diagnosis of acute renal failure. Low urea and high sodium concentrations in the urine suggest acute parenchymal renal failure. High osmolality and high urea concentration suggest good tubular function. Low osmolality and sodium concentration, however, may be diagnostic of neither. Control of renal circulation is thought to depend on a system of autoregulation. The established renal response to volume depletion is renal vasoconstriction, diminished renal blood flow and decreased excretion of sodium and water; measurable reductions in glomerular filtration rate may or may not occur. Volume depletion is also accompanied by secretion of aldosterone and antidiuretic hormone. An entire spectrum, ranging from mild adjustments in volume control to gross pathologic responses, may have as their common denominator varying degrees of change in intrarenal resistance and renal blood flow.

Ischemia is thought to be the common factor in the production of acute renal failure in many diseases. It is proved that vasoconstriction plays a great role in producing acute renal failure. In the face of very severe renal vasoconstriction, elevation in perfusion pressure cannot appreciably alter renal blood flow. There is reason to suspect that excessive vascular reactivity may also play a part in the intense prolonged vasoconstriction that leads to renal damage.

The liberation of blood and muscle pigment after injuries is frequently associated with acute renal failure. Pigment excretion in the presence of minimal urine flow may result in a gel that occludes the tubules or, less probably, has a toxic action on tubular cells.

Finally the acute renal failure in various diseases is described.

◇ **Bedside Diagnosis of Carotid-Artery Occlusive Disease. S. Groch; L. Hurwitz; I. Wright, and F. Dowell. pp. 705-707.**

In the present study the authors found that a bedside diagnosis of occlusive disease of the carotid artery is possible in 80 per cent of cases. Fifty-seven patients were studied.

The history of a patient with occlusive disease of the carotid artery can be most variable. However, such patients are prone to repeated transient ischemic attacks. The occurrence of an ipsilateral visual disturbance with contralateral motor or sensory deficit is almost completely diagnostic of the condition. This syndrome occurred in 18 per cent of the patients studied. Somnolence is also an impressive symptom. The most reliable diagnostic measure seems to be ophthalmodynamometry. A reduced pressure in the retinal artery on the side of the proved occlusion was found in 77 per cent of the patients studied. Palpation of the internal carotid artery in the pharynx can be of great assistance. The pharyngeal pulse was found to be absent in 10 of 24 patients with proved occlusive disease of the internal carotid artery. Cervical and ocular bruits and the presence of Horner's syndrome have also been of assistance in establishing a clinical diagnosis.

The authors feel that cerebral angiography is not essential to a clinical diagnosis in the majority of cases.

**PEDIATRICS. Vol. 25, April 1960.**◇ **Use of a Fat Emulsion Infused Intravenously in Infants and Children. S. A. Kaplan; J. Strauss, and A. M. Yuceoglu. pp. 645-655.**

The authors describe the use of a fat preparation intravenously in 121 infusions in 47 subjects, most of whom were infants and children. A stable preparation of cottonseed oil, soya lecithin, dextrose and a stabilizer provided 160 calories per 100 milliliters of preparation. Patients with acute diarrheal disease, chronic caloric deprivation, intestinal fistula or surgery, acute renal failure and nervous system disease received the material over a six hour period at intervals not more frequent than 48 hours. In ten instances, temperatures greater than 101.5° F were

noted in association with the infusion but may have been due to the underlying disease. No other complications were noted. Autopsies were obtained on three patients and a liver biopsy on a fourth. The liver showed a black-brown pigment in the reticulo-endothelial system.

**Genetics and metabolism.** *Childs, Barton.* p. 565.

**Adolescent gynecology — a 5-year study.** *Heald, F. P., and Somers H. Sturgis.* p. 669.

**A study of children with mongolism reared in the home compared to those reared away from the home.** *Centerwall, S. A., and W. R. Centerwall.* p. 678.



## PEDIATRICS. Vol. 25, May 1960.

◇ **Pulmonary Physiology in Children. III. Lung Volumes, Mechanics of Respiration and Respiratory Muscle Strength in Scoliosis.** C. D. Cook; H. Barrie; S. A. DeForest, and P. J. Helliesen. pp. 766-774.

A study was made of 45 patients with scoliosis for total lung capacity, functional residual capacity, vital capacity, inspiratory capacity, residual volume, and maximum breathing capacity using a closed-circuit helium dilution technic and routine spirometry. Of the patients studied, 20 had idiopathic scoliosis, 15 had had poliomyelitis, and 10 were of miscellaneous etiologies. Tables and charts illustrate results, concluding that, while patients with idiopathic scoliosis showed moderate reductions in vital capacity, those with poliomyelitis showed more marked decreases. Residual volume was essentially unchanged in both groups. It is of interest to note that 10 patients studied 18 months after spinal fusion showed reductions in residual volume, functional residual capacity, and maximum breathing capacity.

◇ **Mumps Virus Infection Simulating Paralytic Poliomyelitis. A Report of 11 Cases.** Edwin H. Lennette; Gerald E. Caplan, and Robert L. Magoffin. pp. 788-797.

Eleven male patients were reported originally as paralytic poliomyelitis but were later found to have serological evidence of acute mumps infection without serologic or stool culture evidence of acute poliomyelitis infection. Only two patients manifested parotitis at any time, and they showed signs of meningoencephalitis and weakness before the development of parotid swelling. The degree of paralysis was mild but persisted beyond the acute phase in all cases. Four patients showed continuing slight weakness when reexamined two to five months later. The authors point out that this type of disease and weakness may become more prominent as a cause of weakness as paralytic poliomyelitis decreases.

**Therapeutic agents for reduction of intracranial pressure.** *Matson, Donald D., and James T. Robertson.* p. 738.

**Acute bacterial meningitis in children. A controlled study of antimicrobial therapy, with particular reference to combinations of antibiotics.** *Haggerty, Robert J., and Mohsen Ziai.* p. 742.

**Clinical trial to assess the effectiveness of gamma-globulin in acute infections in young children.** *Finkel, K. C., and J. C. Haworth.* p. 798.

**Immunization of infants with formalinized poliomyelitis vaccine (Salk type).** *Spigland, Hya, and Natan Goldblum.* p. 812.





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## CONTENTS



An Approach to Disability Evaluation. Lawrence I. Kaplan, M.D.; Jerome S. Tobis, M.D., and Milton Lowenthal, M.D. ....	337
◇	
Correlation Between Fibrillation Potentials and Abnormal Chronaxies. W. T. Liberson, M.D., Ph.D., and Raimunds Pavasars, M.D. ....	346
◇	
Heterotopic Ossification, A Problem in Rehabilitation Medicine. Heinz Lippmann, M.D. ....	351
◇	
Grant Award Recipient .....	354
◇	
Survey of Selected Literature .....	355
◇	
Supplement III — 14th Edition Directory. American Registry of Physical Therapists .....	378



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